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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 1786
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1787
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 1788

89 ASTRONOMY 1789
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS N.A.
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1790
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1790
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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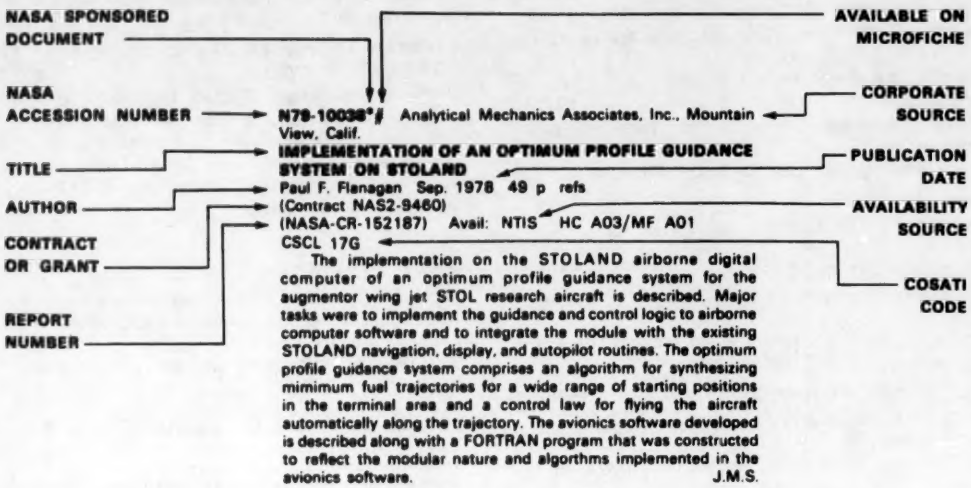
TYPICAL CITATION AND ABSTRACT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Analytical Mechanics Associates, Inc., Mountain View, Calif.
CORPORATE SOURCE
TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
PUBLICATION DATE
AUTHOR
Paul F. Flanagan Sep. 1978 49 p refs
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(Contract NAS2-9460)
(NASA-CR-152187) Avail: NTIS HC A03/MF A01
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COSATI CODE
The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software.
J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, WIND-TUNNEL TEST OF FREE WING/FREE TRIMMER CONCEPT
D.R. Sandlin, California State University & Colleges, California Polytechnic State University, School of Engineering & Technology, Dept. of Aeronautical Engineering, *San Luis Obispo, California* 93407 (NSG 4020)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0002, FLIGHT EVALUATION OF TERMINAL GUIDANCE SYSTEM
D.R. Sandlin, California State University & Colleges, California Polytechnic State University, School of Engineering & Technology, Dept. of Aeronautical Engineering, *San Luis Obispo, California* 93407 (NSG 4022)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0003, ENVIRONMENTAL EFFECTS AND DURABILITY EVALUATION OF ADVANCED COMPOSITE STRUCTURE
H.T. Lund, Hughes Aircraft Co., Division of Summa Corporation, *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0E3836; DAAK51 78 C 0004)

The objective of this work is to develop and fabricate full-scale flight worthy OH-58 tail sections (tailboom, horizontal stablizer, vertical fin) and fly them on service helicopters in place of existing metallic components. The composite tail sections will be flown and maintained under actual service conditions to evaluate the long-term effects of exposure to the natural elements (i.e., heat, cold, moisture, ultraviolet, etc.), coupled with daily service usage.

The initial work will be the development of preliminary design concepts to improve structural performance and reduce fabrication cost. In addition to improved structural designs, the composite tail section will include reasonable design modifications and innovations to enhance ballistic survivability when impacted with 23mm HEI and reduced radar detection. Selected tail section design will be fabricated and tested (both laboratory and flight demonstration) prior to quantity fabrication of tail sections and subsequent service installation and environmental/durability evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0004, CLOSED-LOOP MULTI-AXIS FLYING QUALITIES CRITERIA DEVELOPMENT
E.D. Onstott, Northrop Corp., *3901 W. Broadway, Hawthorne, California* 90250 (DF139480; F33615-77-C-3008)

This effort will contribute to the revision and updating of military specification MIL-F-8785B, 'Flying Qualities of Piloted Airplanes.' AFFDL/FGC has primary responsibility for maintaining this tri-service specification which is used to provide contractual requirements for all new military airplane development programs. New requirements are needed for the development of advanced military airplanes with expanded performance envelopes and complex stability and flight control augmentation systems. Standard methods of specifying requirements have proved inadequate. Therefore, this basic research effort will explore new methods of specifying flying qualities requirements. The results should increase the efficiency and reduce design costs as well as insure improved mission effectiveness. The objective is to provide design criteria that will insure good flying qualities for all phases of military flying missions. These include air-to-air combat, air-to-surface weapon delivery, and safe takeoff and landing operations.

The approach will be to develop flying qualities requirements in terms of closed-loop task related performance measures. This will require development of a means to account for the pilot's effect in the manual control loop. A realistic mathematical description of the pilot must be developed which is applicable to nonlinear airplane dynamics and multi-axis control tasks. Also, a quantitative measure of task performance must be developed that correlates actual closed-loop performance with the pilot's opinion of the airplane flying qualities for the task. Finally, care must be taken to insure the criteria and measurement parameters are consistent with modern control system design and analysis methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, MEASUREMENT SYSTEM FOR HYDROGEN IN AIRCRAFT STEELS (BARNACLE ELECTRODE)
F. Mansfield, Rockwell International Corp., Science Center, *1049 Camios Dos Rios, Thousand Oaks, California* 91320 (DN881537; N62269-77-C-0351)

Since the laboratory phase of the developement of the barnacle electrode has shown that the method is feasible for the measurement of low levels of embrittling hydrogen in high naval aircraft steels, the object of this contract is to improve the design fabricate and deliver three units of a prototype portable apparatus suitable for field use. This contract effort supports work unit DG202, Acession No DN8330889.

The aparatus will be based on the laboratory model developed at NavAirDevCen. The electronics will be assembled from off-the-shelf items with circuitry which will not influence the electrochemistry of the system. The cell attachment will be accomplished by magnetic means and will have a well defined and reproducible area. Testing of the system will be coordinated with NavAirDevCen personnel.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0006, FLOW ANALYSIS OVER AN ADVANCING ROTOR BLADE
K. Karamcheti, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NSG 2370)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0007, DEVELOPMENT OF FLIGHT CONTROL SYSTEMS/FLYING QUALITIES CRITERIA FOR LIFT/CRUISE FAN V/STOL AIRCRAFT

D. McRuer, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DN881486; N62269-78-C-0129)

To establish base line flying qualities requirements, flight control laws, flight path critical displays and control/propulsion integration concepts for a Navy lift/cruise fan aircraft. Supports work unit DH820, DN881124.

Investigations will be conducted to define flight control requirements for a lift/cruise fan vehicle. Flying qualities criteria will be established for the design of a flight control/display system suitable for all modes of flight including hover maneuvering, transition maneuvering, cruise maneuvering, takeoff and landing. The flight control development will address integrated propulsive and aerodynamic control concepts, failure mode effects, pilot station controls and displays, actuation concepts and system reliability. The ability of the flight control/display system to provide satisfactory flying qualities will be demonstrated through piloted simulation at the NASA Ames Research Center.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0008, STUDY OF NEW FLIGHT-TEST TECHNIQUES

J. Roskam, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 4019)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0009, HELICOPTER BLADE-VORTEX INTERACTION AND BROADBAND NOISE

A.R. George, Cornell University, Ithaca Campus, School of Engineering, Dept. of Aerospace Engineering, *242 Carpenter Hall, Ithaca, New York* 14850 (NSG 2360)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0010, CHARACTERISTIC THEORY AND HIGH-FREQUENCY APPROXIMATIONS IN HELICOPTER ACOUSTICS

M.P. Isom, Polytechnic Inst. of New York, Brooklyn Campus, Graduate School, Dept. of Aerospace Engineering & Applied Mechanics, *333 Jay St., Brooklyn, New York* 11201 (NSG 2368)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0011, PROPELLER AERO-ACOUSTIC METHODOLOGY

G.M. Gregorek, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NSG 3247)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0012, A PARAMETRIC STUDY OF HEAT TRANSFER ANALYSIS OF COMPOSITE STRUCTURES

L.S. Han, Ohio State University, Columbus Campus, School of Engineering, Dept. of Mech Engin, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF142200; AFOSR-78-3640)

In order to design survivable aircraft structures accurate vulnerability studies are required. In determining vulnerability of composite aircraft structures to rapid heating threats such as laser weapon systems it is necessary to generate time-temperature profiles in the exposed structure. The object of this effort is to examine the limitations in using the current heat transfer analysis techniques on composite aircraft structures exposed to rapid heating. This effort will identify areas for further work in thermal analysis. This effort will also allow a more realistic appraisal of the structural vulnerability of composite aircraft structures.

A study will be performed to determine limitations in currently available analytical codes. A parametric study will be performed to determine the sensitivity of the analysis results to uncertainties in the thermal material properties and thermal boundary conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, ENERGY METHODS IN THE EXTREMIZATION OF FLIGHT PATH TRAJECTORIES

G.W. Francis, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142240)

This work unit supports advanced aerospace vehicles. The objective of this study is to define methods by which a class of flight path optimization problems may be solved in a simplified procedure. The method and procedures defined will be applicable to the classical performance problems as well as other problems such as tracking and air-to-air maneuvering. The results of this study will lead to a method by which simplified algorithms may be developed for airborne computer use. the development of the actual algorithms will be a following 6.2 effort.

The approach will be to use the energy model of the aircraft dynamics and apply modern optimization techniques to obtain solutions to a class of problems. Theories of controllability and observability will be applied to define the boundaries of the solution and determine the existance of extrema. There has been some contridictory results in the literature in this area. This effort will investigate this problem in depth.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, MULTI-MICROPROCESSOR CONTROL ELEMENTS

J.E. Houtz, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142560)

This program seeks to apply multiple microprocessors to aircraft digital flight control systems. State-of-the-art digital flight control systems are tailored to a general purpose digital computer architecture. This program will apply multiple microprocessors to mechanize a flight control system specifically tailored to flight control requirements. It is anticipated that this program will improve reliability of flight critical control systems and reduce control system hardware and software costs.

Evaluation modules will be breadboarded and candidate microprocessors and supporting hardware will be evaluated in the AFFDL/FGL Development Laboratory. A candidate microprocessor type will be selected as the basic unit for a flight control system design. Based upon the selected microprocessor type, a prototype modularized distributed microprocessor flight control system will be designed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, THE TRANSPORT OF ENERGY IN A COMPRESSIBLE TURBULENT BOUNDARY LAYER

J.D. Walker, Lehigh University, Graduate School, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (NSG 2369)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0016, TIMING OF G-PROTECTIVE TECHNIQUES

M.M. Cohen, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881475)

To determine the sngle and combined effects of the timing of three g-protective techniques, namely seat supination, the M1 maneuver and inflation of the anti-g suit on subsequent human g tolerance.

Five relaxed and restrained subjects shall be exposed to increasing g loading on the dynamic flight simulator while seated in a mechanized supinating seat. Each of three g-protective techniques shall be separately evaluated with respect to the timing of its initiation on subsequent g tolerance as judged by peripheral light loss (PLL) and or reversal of blood flow in the superficial temporal artery. Once time relationships for each of the three techniques with respect to time of g onset have been established, the time relationships for combinations of two techniques and for the combination of all three techniques shall be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0017, LIGHT PLANE HANDLING QUALITIES STUDY AND FLIGHT TESTS

R. Shade, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Langley Research Center, *Hampton, Virginia* 23665 (FA77WAI-797; FA161236 (TRAIS NO.))

Equipment loan and transfer of accountability from the FAA to the NASA Langley Research Center, during the light plane handling qualities study and flight tests being conducted at and by Princeton Universtity under NASA contract.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0018, STRUCTURAL OPTIMIZATION BY FINITE ELEMENTS

G. Sander, Universite de lEtat a Liege, *Rue des Bonnes Villes 1, Liege, Belgium* (DF052830; AFOSR-78-3652)

AF function - improved structural efficiency can enhance the performance of future Air Force flight vehicles. Opportunity - new digital computer systems make possible the study of analysis methods used to achieve minimum weight high-performance designs. Objective - to develop efficient and accurate analysis methods in order to develop minimum weight aircraft designs. How work contributes - integrated methods to improve the design of aircraft structures will directly assist future lightweight vehicles.

Research will extend the previous efforts to develop rigorous solution procedures to minimum weight structural design problems using a mixed method which involves both optimality criteria and mathematical programming. Development of an efficient and accurate algorithm to control the convergence of the method will be studied in order to select critical constraints, particularly stresses, that require exact linearization. Extension of the mixed method approach will study dynamic constraints on mode shapes, frequencies and stress levels.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, GRAPHITE-EPOXY COMPOSITE PROTECTIVE COATINGS

L.A. Mayer, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2371)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0002, INVESTIGATION AND DEVELOPMENT OF AEROSPACE RECOVERY SYSTEM MATERIALS

D. Reinhold, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN895412)

To obtain necessary information and develop safe and economical techniques for establishing: (a) service life of materials, components, and systems; (b) maintenance procedures for systems and components; (c) storage and packing techniques and environments for materials and components. Goals are to increase service and storage life, minimize maintenance, reduce bulk of packed parachute, and maintain or increase present reliability and performance standards.

Conduct test and evaluation to form a basis in theory, equations, and empirical data relating to material creep; cyclic fatigue; environmental effects of pressure packing, inert atmosphere storage, and packing methods, and destructive and non-destructive testing. These data will be used to establish service life, maintenance procedures, and storage/packing procedures, age life, and service life.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0003, CHEMICAL REACTIONS OF ATMOSPHERIC HALOGENATED SPECIES

M.J. Molina, University of California, Irvine Campus, School of Physical Sciences, Dept. of Chemistry, *Irvine, California* 92664 (R805532-01; G603A-AI-07)

The purpose of this research is the understanding of the various atmospheric chemical and photochemical reaction involving halogenated species. These include the halocarbon compounds in current technology, the intermediate halogenated radicals released during their atmospheric decomposition, and compounds formed in situ by atmospheric reactions. The ultraviolet absorption spectra of brominated molecules often extend into the 2900-3100A region near the atmospheric cut-off of stratospheric ozone. Long-path UV absorption spectra will be measured for various brominated species (e.g. CBr2F2) to determine which molecules can undergo appreciable tropospheric solar photodecomposition. The chemical reaction mechanisms of important 'semi-stable' molecules formed in the atmosphere will be studied. Flash photolysis will be used to determine whether the halogenated species released in the photodecomposition of chlorine nitrate is ClO, ClONO, Cl or ClNO. Flash photolysis will be used to determine whether ClONO2 is the sole product from the reaction of ClO with NO2. Peroxynitric acid (HO2NO2) will be synthesized and its u.v. absorption spectrum will be measured. Radioactive tracer techniques will be applied to the determination of the chemical fate of halogenated radicals reacting with air. These tracer radicals can effectively simulate the very low concentrations of organic species in the actual atmosphere. The possible formation of aldehydes from the oxidation of halo radicals will be investigated, e.g. for CH3CCl3, the formation of 14CH3CClO from 14CH3CCl2 plus O2. The reactions of the residual radicals from CH3Br decomposition will be traced using radioactively-labeled CH282Br.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

3.0004, AEL DATA CENTERS - CTR

W.C. Martin, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (2320412)

PROJECT OBJECTIVE: To supply critical compilations of atomic energy levels data needed for plasma diagnostic in CTR research and for the interpretation of astrophysical spectra. Atoms and ions of the first 28 elements, especially iron-group elements, are curently emphasized. Also to supply references and information on unpublished results of interests to DOE and space astronomy researchers.

PROJECT APPROACH: We are producing a series of compilations for the lighter elements, including the iron-group elements, each publication giving the energy levels for all ions of a particular element. The data are critically evaluated for experimental and theoretical consistency, and we include calculated eigenvector percentages for the levels where available and ap-

plicable. A bibliographic reference file on atomic spectroscopic data of CTR and space astronomy interest is kept current.

PRIOR YEAR ACCOMPLISHMENTS: Compilation of energy levels for the vanadium ions were completed. More than 100 references for atomic data of CTR interest were supplied for the DOE newsletter atomic data for fusion.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

3.0005, PERFLUOROETHER TRIAZINE ELASTOMERS
R.A. Korus, University of Idaho, Graduate School, *Moscow, Idaho* 83843 (NSG 2367)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0006, USE OF CERAMICS IN AIRCRAFT ENGINE BEARINGS
M.O. Torti, Norton Co., *1 New Bond St., Worchester, Massachusetts* 01606 (DN890106; N00019-77-C-0551)

The objective of this procurement is to investigate the utility of ceramics as a means of increasing performance capabilities, service life or environmental resistance of rolling element bearings for use in turbine engines.

The load life relationships of steel on ceramics and ceramics on ceramics will be evaluated in rolling contact fatigue tests. Aircraft quality precision rolling element bearings with ceramic races and rollers will be designed, fabricated and tested. Silicon nitride and/or silicon carbide are the materials of primary interest.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0007, LABORATORY AND OBSERVATIONAL SPECTROSCOPIC STUDIES OF MOLECULES AND PROCESSES OF ASTROPHYSICAL INTEREST
W.H. Smith, Washington University, School of Arts & Sciences, Dept. of Chemistry, *4559 Scott Ave., St. Louis, Missouri* 63130 (AST78-12799)

This research is aimed at the elucidation and discovery of molecular spectra of species known or believed to be of substantial importance in a number of astrophysical objects, including the atmospheres of the major planets (e.g., CH4, NH3, and H2) and the diffuse interstellar clouds and comets (e.g. CH2 ion, HeH ion, H2O ion, and H3O ion). The stable species will be investigated with laser photoacoustic spectroscopy at high spectral resolution and S/N using as little as 10 to the minus 4th power of the material required by conventional methods. The spectra of the molecular ions will be investigated with laser methods, using in some cases Fourier Transform spectrometers. Great sensitivity is achieved by these methods, with estimated levels of 10 to the 2nd power to 10 to the 6th power species per cc being detectable. This research represents a continuation of that currently supported by Foundation Grant AST 77-06050.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

3.0008, THE STUDY OF EPOXY BLENDS AND CATALYSTS
E.M. Pearce, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Chemistry, *333 Jay St., Brooklyn, New York* 11201 (NSG 2361)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0009, MATERIALS CHARACTERIZATION
J.A. Bruce, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903470)

AF function - development and improvement of electromagnetic materials and components used in C3 applications. Deficiency - need to characterize and evaluate structure and properties of EM materials and components to aid in their development and improvement. Objective - to characterize, evaluate and measure the properties of materials and device structures in both thin film and bulk form. How research contributes - this work is direct support of both the materials and device technology areas of the laboratory.

Various x-ray diffraction and electron beam techniques such as SEM, TEM, electron diffraction and auger electron spectroscopy, will be used to characterize and evaluate EM materials and structures. Other techniques such as optical microscopy, microhardness thermal conductivity measurements will be applied as needed. Specimen fabrication (cutting, polishing) and glass blowing services will be provided. The application of these techniques will yield information on structure and crystallinity of materials, chemical composition, surface structure and composition and defect density and structure in both bulk and thin film materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0010, ANISOTROPY OF DIRECTIONALLY SOLIDIFIED NICKEL-BASE SUPERALLOY MONOCRYSTALS
R.D. Maier, Case Western Reserve University, Graduate School, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NSG 3246)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0011, IMPROVED MOISTURE RESISTANCE OF FIBER-REINFORCED PLASTICS 14740-MS
J.L. Koenig, Case Western Reserve University, School of Engineering, Dept. of Macromolecular Science, *University Cir., Cleveland, Ohio* 44106 (DA0F9264; DAAG29-78-G-0148)

To study the chemical reactions induced by water vapor at the interfaces in fiber-reinforced plastic composites, and to relate these results to mechanical performance of the composites. Relevance - the research is relevant to the environmental deterioration of epoxy matrix composites which are used in Army aircraft, missiles, and packaging for shipping of material. This deterioration is reportedly the number one materials problem for Army aircraft.

Study moisture attack on the untreated surface of glass fibers using vibrational spectroscopy. Study the reactions of coupling agents with glass surfaces to determine optimum conditions for coupling. Study the chemical changes caused by the presence of moisture in the coupling agent, glass surface, and adjacent matrix. Measure the mechanical properties of the composite in various stages of exposure to moisture.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0012, THERMAL PROTECTION COATING FOR IMPROVED WEAPONS COOK-OFF
I.O. Salyer, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (NSG 2373)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0013, COMBAT DAMAGE-TOLERANT FIRE CONTAINMENT BARRIERS
I.O. Salyer, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (NSG 2374)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0014, RESEARCH OF FATIGUE AND ULTRASONIC ANALYSIS OF MATERIALS ELASTIC PROPERTIES
Unknown, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (NCA 1-13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0015, HIGH RESISTIVITY GRAPHITE FIBERS
F.L. Vogel, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (NSG 1596)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0016, QUANTITATIVE ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS IN LIQUID FUELS
F.G. Mesich, Radian Corp., *8500 Shoal Creek Blvd., Austin, Texas* 78766 (68-02-2446; G712B-BC-04)

The object of this project is to quantitatively determine 12 individual polynuclear aromatic hydrocarbons, (PNA's) at the parts per billion level (ppb) present in various aircraft turbine, diesel, and gasoline test fuels. The correlation between PNA levels in mobile source exhaust emissions and pre-existent PNA's in liquid hydrocarbon fuels is currently being investigated.

The project's approach first involves the shipment of the various test fuels in one gallon containers to the contractor; second, isolation and concentration of the PNA's from the liquid hydrocarbon fuels using a proven liquid-liquid extraction procedure; and finally separation and quantification of the isolated PNA's using gas chromatography (GC) and combined gas chromatography-mass spectrometry (GC/MS) techniques.

Results to date from 6 different diesel fuel and 3 different aircraft turbine fuel analyses indicate that PNA's were present in these liquid hydrocarbon fuels. The levels of the PNA's present ranged from trace amounts to approximately 1000 parts per million (ppm). One of the PNA's present in all fuels tested was the known carcinogen Benzo(a)Pyrene (BaP) in the 7 to 100 parts per billion (ppb) concentration range.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

3.0017, MECHANISTIC STUDIES OF PREBIOTIC CHEMISTRY
W.A. Guillory, Utah Higher Education System, University of Utah, School of Science, Dept. of Chemistry, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NSG 7516)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0018, INVESTIGATION OF THE FORMATION OF DIFFUSION BARRIER MATERIALS ON SILICON CARBIDE FILAMENTS AND THEIR INCORPORATION INTO METAL MATRIX COMPOSITES
F.E. Wawner, University of Virginia, School of Engineering & Applied Science, Dept. of Materials Science, *Garrett Hall, Charlottesville, Virginia* 22903 (NSG 3242)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0019, CONFIGURATION INTERACTION
E.R. Davidson, University of Washington, School of Arts & Sciences, Dept. of Chemistry, *Seattle, Washington* 98105 (NSG 2365)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, EVALUATING THE FEASIBILITY OF DETECTING AND MEASURING LIGHTNING DISCHARGES FROM A SPACE STATION
J.D. Irwin, Auburn University, Graduate School, *Auburn, Alabama* 36830 (NCA 8-133)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0002, SURVEILLANCE - LARGE MIRROR STRUCTURES
W.S. Smith, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (DN875284; N00014-78-C-0282)

The objective of this work unit is to design and theoretically analyze improved large optical structures of a type suitable for satellite mounted surveillance systems for use in the Navy.

To accomplish the proposed objective, structural forms will be designed with predicted optical surface position control capabilities that exceed those of present designs. The latter are characterized by a diameter-to-thickness ratio on the order of 6:1 with actuators imbedded in the structure. Design degrees of freedom will include depth-of-structure, tiers of actuators, and weight. Figures-of-merit will be defined for expressing the improvements achieved by the new structure designs, and these will be used for comparison and evaluations. The design domain will include mirror diameters from 10-300 meters and wavelength from 1 to 3000 microns, with the shorter wavelengths corresponding to the smaller diameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0003, HEAT TRANSFER AND FLOW CHARACTERISTICS OF EXTENDED SURFACES
G.M. Benson, Energy Research & Generation Inc., *952 57th St., Oakland, California* 94608 (DN875336; N00014-78-C-0271)

Experimental and analytical research will be conducted to determine the thermodynamic and fluid dynamics properties of advanced extended surfaces, including foil fins and reticulated matrices. The latter offer high area-to-volume ratio, minimum resistance to fluid flow, and (predicted) low manufacturing and assembly costs, important characteristics of advanced heat exchangers for ship and aircraft propulsion and auxiliary power applications.

Measurements will be made of temperatures, pressures, and flow rates for ranges of wetted Reynolds number and foil fin and pore densities for air and helium working fluids. Analytical formulations will be made to predict variations of heat transfer and fluid flow resistance.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, AVAILABILITY/OPERATIONAL READINESS TEST COST TRADE-OFFS
D.E. Tuttle, Lockheed Aircraft Corp., *2555 N. Hollywood Way, P.O. Box 551, Burbank, California* 91503 (DF736760; F30602-78-C-0179)

Recent and independent studies performed under the auspices of the air staff, project ACE, and the GAO point out the fact that avionics test equipment (built-in and external) and diagnostics impact both acquisition cost and support cost of systems to a critical degree. Further analyses performed by HG AFSC and

RADC resulted in the conclusion that no evaluation or trade-off techniques were available to either government or industry to provide visibility or to guide the design of cost-effective test equipment (diagnostic procedures, built-in-test, external test). In addition, it was determined that the characteristics and efficiency of such test equipment when used in a weapon system critically impact the operational readiness/availability of the systems through effects on both reliability and maintainability. Again investigations indicated a paucity of information and procedures pertaining to the relationship between the operational readiness/availability of a system and its test equipment type, design, and characteristics. The above points out the need for system availability/operational readiness, test equipment design, cost trade-off guidelines, procedures, and information. It is the purpose of this effort to initiate a program to provide these tools.

The approach to the above will combine (1) collection of data relative to the types of and characteristics of test equipment presently in use and (2) engineering investigation of operational readiness/availability characteristics as a function of design and type of test equipment, (3) engineering investigation of the design/cost trade-offs possible for each candidate/concept studies. Sources to be chosen from responses to Commerce Business Daily.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0005, AEROELASTIC OPTIMIZATION WITH MULTIPLE CONSTRAINTS

S. McIntosh, Nielsen Engineering & Research Inc., *850 Maude Ave., Mountain View, California* 94040 (DF053140; F49620-78-C-0105)

AF function - advanced flight vehicle structures of lighter weight and increased durability will be necessary to achieve future Air Force mission requirements. Deficiency - current aerospace vehicle designs do not reflect consistent consideration of disciplines influencing structural designs. Objective - the objective of this research program is to investigate structural optimization techniques applicable to multiple constraint conditions representative of aerospace vehicles. How work contributes - this effort is part of a program to develop the basic capability required to achieve optimal structural design in the Air Force.

Research program will investigate the efficiency and accuracy of basic solution algorithms for minimum weight structural designs. Primary attention will be given to math programming (MP) and optimality criteria (OC) algorithms involving flutter speed and vibrational constraints. Fixed and variable mode coordinate will be used in examining convergence to flutter speed and computational efficiency. Delta wing and high aspect ratio wing configurations will be used to investigate the solution accuracies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, MIXED KERNEL FUNCTION METHOD FOR UNSTEADY TRANSONIC FLOW CALCULATIONS

D.D. Liu, Northrop Corp., *3901 W. Broadway, Hawthorne, California* 90250 (DF137390; F33615-78-C-3202)

This work unit supports the area of transonic flutter prediction. Establishing flight flutter safety for military aircraft is presently difficult and costly for the transonic speed regime. The objective of this effort is to provide an efficient and accurate transonic flutter prediction method. Increased confidence and reduced costs are expected for establishing flight flutter safety in the transonic flight region.

Develop and demonstrate a unified method for unsteady flow in the subsonic/transonic/supersonic regimes based on the 'mixed kernel function' method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0007, NUMERICAL VORTEX TRACING

O. Buneman, Stanford University, Inst. for Plasma Research, *Stanford, California* 94305 (DN875232; N00014-78-C-0272)

The development of accurate numerical procedures for predicting high Reynolds number flows will lead to improved methods for optimizing the performance of aircraft, ships, and missiles. The purpose of the proposed research on three-dimensional turbulence will be to develop a viable and accurate vortex tracing method which will be able to simulate, for special cases, the evolution of turbulence.

The basic approach of the proposed method is to represent the continuous distribution of vorticity in a flow field by discrete, closed, vortex filaments. In this model, viscous effects will occur only in the internal structure of the vortex filaments. Since viscous effects are neglected elsewhere, the vortex filaments move with the local fluid velocity. The velocity field is not calculated directly from Biot-Savart's law but by integrating a Poisson equation on an appropriate mesh. Once the velocity field is established, the fluid elements along each vortex filament are advanced in time to establish a new vorticity distribution.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, ACTIVE AND PASSIVE MAGNETOSPHERIC PROBING AT VLF - A PROGRAM OF DATA ANALYSIS AND DATA ACQUISITION

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engin, *Stanford, California* 94305 (ATM78-05746)

This award supports a grant for very low-frequency (VLF) research on the properties of the earth's magnetized plasma envelope or magnetosphere. The program has two major components: (1) data acquisition at Roberval, Quebec, Canada, with emphasis on the reception of signals from an experimental VLF transmitter located at Siple Station, Antarctica, and (2) analysis from both active and passive probing experiments. The passive experiments will include coordinated international observing campaigns, direction finding compaigns, and multi-technique observations from a single location. The program is aimed at gaining understanding of wave particle interaction in the magnetosphere and of the distribution and dynamic behavior of the 'cool' background component of the magnetospheric plasma. The importance of these studies lies in the fact that the magnetosphere plays an important role in transmitting energy from the sun to the earth. Wave particle interactions within the magnetosphere are believed to be important factors in the process of energy storage and flow within the magnetosphere. Furthermore, the particular ways in which these processes occur in the middle atmosphere may reveal fundamental properties about magnetized collisionless plasmas as they exist elsewhere in the universe.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

4.0009, AXIAL FIELD PERMANENT MAGNET MOTORS FOR ELECTRICAL VEHICLES

P.E. Campbell, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 3243)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0010, ADVANCED TECHNOLOGY RESEARCH AND DEVELOPMENT FOR FLIGHT SYSTEMS PROBLEMS

C.T. Leondes, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Engineering Systems, *405 Hilgard Ave., Los Angeles, California* 90024 (DF141870; AFOSR-78-3486)

Develop modern control technologies for application to advanced flight vehicles. Control configured vehicles will provide new dimensions in aircraft guidance and control. New flight control systems must be designed to efficiently integrate and effectively utilize the advanced capabilities of these aircraft. Basic research will be conducted to formulate a functional flight control design using optimal control and other advanced design techniques. The design will be intended for use on advanced aircraft with new control capabilities.

Conduct graduate theses research to develop the theoretical basis for advanced control systems. Modern control theories will be investigated for application to the air-to-air and air-to-ground combat problems and to precision trajectory tracking and end point attainment with environmental disturbance accommodation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0011, WORKSHOP ON FUNDAMENTALS OF TURBOJET COMBUSTION
M. Gerstein, University of Southern California, School of Engineering, Dept. of Mechanical Engineering, *3551 University Ave., Los Angeles, California* 90007 (NSG 3248)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0012, BOUNDARY LAYER TRANSITION
J. Laufer, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF052070; F49620-78-C-0060)

AF function - advanced aerospace vehicles. Opportunity - to gain insight into the pressure and velocity feedback mechanisms effects on the stability of jet flows. Objective - experimentally investigate the causes and effects of the resonance conditions of impinging jets. How work contributes - all fluid flows transfer energy and momentum to or from flows of different velocity, pressure and temperature through convective-shear flow mechanisms. In the past this mechanism has been viewed as a random small eddy, i.e., Prandtl's mixing length, or a molecular diffusivity mechanism. Within the last decade or so large vortical structures with the shear flow have been observed and documented, however, the relationship or existence of these large structures in fully turbulent, high-velocity boundary or free shear flows is not known. This research will provide needed information and diagnostic techniques to further our understanding of how pressure and velocity feedback mechanisms affect the stability of the flow field, create the large scale structures of vorticity and control their behavior. It will also contribute data on the interaction of these flow field effects and solid boundaries. This information will provide new concepts and understanding for the design of future aerospace vehicles.

Experimental configurations of an axisymmetrical jet (heated and unheated) impinging on a large flat plate normal to the axis of the jet will be investigated in a anechoic chamber. Conditional sampling data of pressure fluctuations, temperature fluctuation and heat transfer rates on the plate along with the far field noise will be measured and analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, ION-WAVE INSTABILITIES IN LASER-GENERATED PLASMAS
E.J. Yadlowsky, Colorado State University, School of Engineering, Dept. of Electrical Engin, *Fort Collins, Colorado* 80523 (ENG77-28250)

Thomson scattering of a ruby laser from a pulsed carbon dioxide laser-generated plasma will be examined and the frequency spectrum of scattered light as a function of scattering angle relative to the direction of propagation of the CO2 laser will be determined. From these measurements, confirmation of the existence of ion-wave instabilities in the plasma, determination of their direction of propagation, and identification of the mechanism of excitation of ion-wave instabilities will be sought. Several possible mechanisms for instability generation including the flux of low-energy electrons from the plasma and the ion-ion two stream effects will be examined.

The clear identification of the existence of the ion-wave instability and its associated excitation mechanism will greatly assist in the determination of the importance of ion-wave instabilities in laser absorption and thermal flux limitations. The work will also demonstrate the utility of the Thomson scattering technique in the study of instability phenomena in dense plasmas.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0014, LOW-COST TERMINALS USING REMOTELY GENERATED CROSS-CORRELATION REFERENCES
J.W. Sennott, Howard University, Graduate School, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 5336)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0015, TESTING OF A LIGHTNING DETECTION AND RANGING (LDAR) SYSTEM
Unknown, U.S. National Aeronautics & Space Admin., *600 Independence Ave. S.W., Washington, District of Columbia* 20553 (FA78WAI-900; FA161287 (TRAIS NO.))

Provide and install a LDAR display unit at the Patrick AFB RAPCON. Prepare a test plan and conduct a joint FAA/NASA/USAF 3-month evaluation of the LDAR System. The test plan shall provide the following: (a) Brief description of the LDAR System, noting its capabilities and accuracies in locating lightning; (b) Description of test to be conducted in the Air Traffic Control System; and (c) Sample test data sheets indicating type of data to be recorded.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0016, THREE-DIMENSIONAL TRANSONIC DATA ACQUISITION AND EVALUATION
B.L. Hinson, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF052310; F49620-78-C-0068)

AF function - advanced aerospace vehicles. Deficiency - a lack of reliable experimental data for isolated wings in transonic flow that is suitable for use in developing and evaluating computational methodologies. Objective - to obtain a set of high-quality experimental data for isolated wings suitable for evaluating new and future theoretical subsonic and transonic aerodynamic methods, to determine the influence of simple fuselage simulations on the wing aerodynamics, and to evaluate the level of accuracy and computational efficiency of representative versions of the new three-dimensional transonic computer codes. How work contributes - the acquisition of a reliable set of transonic wing data will provide a means for comparison of the various new and developing three-dimensional transonic codes which can differ in problem formulation, grid arrangement, finite difference schemes, and solution algorithms. With the availability of a good data base, methods can be assessed. Ultimately, the active use of these computer codes in aircraft design will depend to a large degree on the confidence developed through comparisons with good quality data.

Two supercritical wings, one of high and one of low aspect ratio, designed to produce well-behaved flows will be tested in a high Reynolds number wind tunnel incorporating tunnel wall, boundary layer removal allowing simulation of true isolated wing conditions. The half span wings will be tested with and without a fuselage representation for a range of Mach numbers and angles of attack at which no extensive shock or pressure gradient induced boundary layer separation occurs. Both surface pressure (approximately 160 pressure orifices in each wing) and force balance readings will be taken. Also, a set of computational results will be generated and comparisons made for these test wings using the Bailey-Ballhaus small disturbance code, the Jameson full potential equation code, and the Jameson finite volume code.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0017, ADVANCED TRANSONIC TECHNOLOGY
G. Spacht, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF141350; F33615-78-C-3014)

Development of both transport and fighter designs will be accomplished. Transports, which cruise at transonic conditions, and

fighters, which maneuver at transonic conditions, have been designed in the past by use of 2-D transonic and 3-D subcritical methods, although most design problems are 3-D in nature. The objective of this effort is to develop more efficient transport and fighter configurations than possible in the past and at a lesser cost.

Recently developed 3-D transonic methods will be applied to the aerodynamic development of transport and fighter configurations, and improvements to methods will be made as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0018, CODING FOR MEMORYLESS MULTIPLE-ACCESS CHANNELS

S. Lin, University of Hawaii System, Manoa Campus, School of Engineering, Dept. of Electrical Engin, *Bachman Hall, Honolulu, Hawaii* 96822 (ENG78-05151)

Recent developments in satellite communication systems, computer communication networks and other communication systems involving multiple-users require the investigation of the problem of the simultaneous transmission of information amongst several terminals over a common communication channel. Recent research results indicate that multiple-users can communicate data with arbitrarily small probability of error over a common memoryless channel provided that the rates for the individual data streams lie within the capacity region for the channel.

This research program is concerned with coding for a special multiple-user communication channel called the memoryless multiple-access communication channel. The objectives of the research are: (1) to construct good (block or trellis) codes for the memoryless multiple-access communication channel; (2) to find practical methods for encoding and decoding these codes.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0019, ELECTRON BEAM CONTROLLED GAS LASERS

T.A. Detemple, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (ENG75-21515 A01)

The use of electron beams as an aid in obtaining laser operation at high pressures is now a demonstrated technique. Direct beam excitation has been employed in rare-gas halide lasers, charge exchange lasers and rare-gas molecular lasers. Alternately using the beam as an ionizer with the predominate excitation coming from a conventional energy storage sustainer supply has resulted in substantial performance from CO and CO2 infrared lasers.

This research program concerns the use of an ionizer-sustainer mode of operation as a means of studying laser action at high pressures with the general goals of seeking new transitions and obtaining enhanced performance from known transitions. In addition extended electron diagnostic experiments and optical pumping experiments will be conducted.

This research is a continuation of a program previously supported under National Science Foundation Grant No. ENG-7521515.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0020, ELECTRONIC COMPONENTS FOR A/C PROPULSION CONTROLS

G. Serovy, (No Performing Organization Reported), Ames 50010, *Iowa* (DN890074; N00019-78-M-0286)

A research study to evaluate the effect of component performance trends and propulsion system cycle variants on jet engine control system design and development.

Major aircraft engine companies will be contacted by the investigator to assist him in assessing electronic control needs for future high-temperature jet engines.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0021, INVESTIGATION OF DRAG REDUCTION FOR TRACTOR-TRAILER VEHICLES WITH AIR DEFLECTOR AND BOAT TAIL

V.U. Muirhead, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 4021)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0022, DESIGN OF VHF AND UHF COMMUNICATIONS AIR/GROUND ANTENNAS

Unknown, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Labs., *2800 Powder Mill Rd., Adelphi, Maryland* 20783 (FA78WAI-851; FA161219 (TRAIS NO.))

HDL shall conduct a research, development, design, fabrication, and test effort that will produce state-of-the-art designs of a minimum of two models of each of three types of radio antennas for operation over two frequency ranges, VHF (118-136 MHz) and UHF (225-400 MHz). HDL shall also provide consultation and technical advice to FAA.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0023, FEASIBILITY STUDY FOR FINE STRUCTURE SOLAR ENERGY CONVERTER

L.S. Taylor, University of Maryland, College Park Campus, School of Engineering, Dept. of Electrical Engineering, *College Park, Maryland* 20742 (NAS 5-25437)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0024, COMBUSTION AND OPERATING CHARACTERISTICS OF SPARK-IGNITION ENGINES

J.B. Heywood, Massachusetts Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 3245)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0025, FAULT-TOLERANT WEATHER RADAR DATA PROCESSOR

A.J. Jagodnik, Raytheon Co., *528 Boston Post Rd., Sudbury, Massachusetts* 01776 (DF580690; F19628-78-C-0113)

AF function - navigation and detection functions of the strategic, tactical, air defense, and airlift forces. Deficiency - the safe and efficient performance of these functions is impaired because malfunctions of weather radar equipments are oftentimes not diagnosed in a timely and efficient manner. Objective - to fabricate a fault-tolerant weather radar data processor and integrate it into the existing data recording system. How development contributes - overcomes deficiencies by automating the time consuming functions of locating faults and assuring the quality of the information processed by the radar system.

Design programmable circuit board which performs required functions, checks and verifies output for accuracy, and if malfunction appears automatically replaces faulty board.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0026, FLOW VISUALIZATION AND HOT WIRE ANEMOMETRY STUDY OF TURBULENT SPOTS

R.E. Falco, Michigan State University, School of Engineering, Dept. of Mech Engin, *Engineering Bldg., East Lansing, Michigan* 48824 (DF053460; AFOSR-78-3703)

AF function - aerospace vehicles. Opportunity - provide increased understanding of the role turbulent spots play in transition from laminar to turbulent boundary layer flows and in fully

turbulent boundary layers. Objective - arrive at a consistent picture of the turbulent spot dynamics as well as spot formation and spreading mechanisms. How work contributes - new and improved prediction methods are needed for transition and fully turbulent flows by designers of advanced aerospace vehicles. This effort will provide insight on how the building blocks of turbulence are combined and how present analysis can be extended to non-flat plate flow fields.

The interior of turbulent spots will be examined in an air tunnel capable of continuous visualization using a fog of oil droplets. The boundary layer will be illuminated using laser light slices parallel and normal to the solid boundary and photographed either in a stationary or moving frame of reference using high-speed cinematography. Simultaneous hot-wire anemometry will also be taken. Air velocities up to 21 feet/sec and Reynolds numbers up to 10 to the 6th power will be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, LASER HARDENING THROUGH FLUID MECHANICS

H.W. Kipp, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF133150; F33615-78-C-3002)

Air Force vehicles operating at moderate to high speed may be subjected to laser attack in the near future. This induced thermal environment must be properly considered in the design process of future vehicles. Methods by which this threat may be countered or reduced must be explored. This work unit will explore the possibility of dissipating laser energy at the vehicle's surface through techniques of fluid mechanics. By ejecting a fluid into the boundary layer over critical vehicle components the laser energy may be dissipated thereby protecting the vehicle from critical damage and assuring mission success.

Through both experimental and analytical means this work unit will investigate the interactions between fluid flowing over a surface and various levels of impinging laser energy. Different fluids will be examined as a means of dissipating the laser energy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0028, CONVECTIVE IGNITION OF NITROCELLULOSE-BASED PROPELLANTS IN NONSTEADY FLOW FIELDS 15994-E

W.A. Sirignano, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mech Engin, *Box 430, Princeton, New Jersey* 08540 (DA0F9242; DAAG29-78-G-0153)

To continue research on convective ignition of nitrocellulose-based propellants to determine the site and mode of convective ignition of cylinders in cross flow and to determine the influence of igniter gas composition on the ignition events. Relevance - the results of this research can be incorporated in packed bed propellant studies that are of mission interest to both the ignition and the gun propulsion technology programs of the Large Caliber Weapons Systems Lab.

A model is being developed which includes heat-up to gasification, flow of reacting gases around a specified cylinder geometry, and accumulation and reaction of combustion intermediates in the flow wake.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0029, RESEARCH AND DEVELOPMENT OF ANTENNAS FOR RESEARCH ROCKET AND SATELLITE APPLICATIONS

H.G. Dennis, New Mexico State University, Las Cruces Campus, Graduate School, *University Park, Las Cruces, New Mexico* 88003 (DF580200; F19628-78-C-0052)

AF function - command, control and communications. Deficiency -reduced effectiveness of systems for acquiring reliable telemetry data and trajectory information from R&D research probes, and for exercising command and control of these vehicles. Objective - to develop type acceptable antenna systems for AF R&D rocket probes and satellites. Improved reliability of systems for telemetry data transmission, trajectory determination, vehicle command and control, or other electromagnetic transmission and reception applications will be the final objective of this work. How research contributes - the development of highly reliable antennas will increase the effectiveness of instrumentation systems used to support AF R&D rocket and satellite programs.

Design and development will be based on the specific type of research vehicle to be instrumented and the various operational constraints. Antennas developed will be tested on an antenna range and on the research probe when possible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0030, ASDE-3 ENGINEERING MODEL RADAR WITH DISPLAY ENHANCEMENT UNIT

Unknown, Cardion Electronics Inc., *Long Island Expy., Woodbury, New York* 11797 (TSC-1373; TS144565 (TRAIS NO.))

The objectives of this procurement are as follows: Develop an engineering model of a cost-effective, reliable, all-weather airport surface detection radar which will provide the local and ground controllers a clear, accurate and bright presentation of the stationary and moving traffic on the airport surface. This basic radar will be compatible with two types of configurations: a) a remote tower installation, and b) a control tower installation.

SUPPORTED BY U.S. Dept. of Transportation, Research & Special Programs, Transportation Systems Center

4.0031, AN ANALYSIS OF AN INVENTORY SYSTEM FOR INTERCHANGEABLE RECOVERING ITEMS

J.A. Muckstadt, Cornell University, Ithaca Campus, School of Engineering, Dept. of Operations Research, *242 Carpenter Hall, Ithaca, New York* 14850 (DF051740; AFOSR-78-3568)

AF function - to repair and maintain complex equipment in aerospace vehicles and ground installations, and to develop better methods in inventory control to expedite the performance of the required maintenance. Deficiency - in many situations, a faulty component can be replaced by any of several types of parts, with some parts being more sophisticated or versatile than others because of possible demands in other more complicated systems than the one under repair. How many of the various types to stock, and which of several kinds to use when replacement is possible entails decisions for which there is no satisfactory basis at this time. Objective - to develop analytic tools that will aid in the study of this problem area. How work contributes -success in this research could lead to significantly smaller inventory costs or fewer backorders, with a smaller proportion of inoperable machines.

The two-echelon supply system will be somewhat simplified to get an efficient model, and a number of intuitively near-optimal substitution rules will be evaluated. Analytic procedures will be used where possible, exploiting good approximations to the extent possible. Computation simulations will be used where necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0032, COOPERATIVE INVESTIGATION OF THE NOISE-PRODUCING REGION OF AN AXISYMMETRIC JET

W.K. George, State University of New York, Buffalo Campus, School of Engineering & Applied Science, Dept. of Mech Engin, *3435 Main St., Buffalo, New York* 14214 (DF051640; F49620-78-C-0047)

AF function - advanced aerospace vehicles. Opportunity - fundamental understanding of the sources of noise and vibration caused by mixing gaseous flows is not available. Recent investigations provide evidence that coherent structure of the turbulent flow field either is the source or the carrier of the source for the radiated acoustic energy. This effort provides the opportunity to investigate the correlation between the coherent structure of a jet and its radiated noise and also to investigate the existence of coherent structure in the midfield of a jet flow field and techniques for its detection. Objective - comprehensive study,

both experimental and analytical, of the turbulence structure of low Reynolds number jets and its relation to jet noise. How work contributes - noise radiated from jet mixing flows are not only unpleasant from an enviornmental standpoint but induce vibrations within the solid structure of the vehicle and adjacent structures reducing system reliability and fatigue life. Better understanding of the physics involved in the jet flow field and resulting acoustic energy will allow more efficient and reliable components such as jet exhaust nozzles, jet pumps and augmented jets.

The investigation will study RE lower than that at which visually observable structures disappear and will be carried out as a three-university effort at SUNY, Buffalo, the University of Minnesota and the Illinois Institute of Technology. All three investigations will be experimental and will be carried out on similar axisymmetrical jets at identical reynolds numbers. To insure similarity, traditional turbulence measurements (turbulence intensities, etc.) will be obtained on each apparatus for comparision. The SUNY will apply Lumley's orthogonal decomposition to the velocity and temperature fields, the University of Minnesota will apply orthogonal decomposition to the radiated noise field and the Illinois Institute of Technology will resolve the observable velocity structures by visualization techniques. Detailed analysis of these data will attempt to resolve the existence (or nonexistence) of the relationships between the coherent structures and the acoustic radiation field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, PLASMA STABILITY THEORY

A. Simon, University of Rochester, School of Engineering & Applied Science, Dept. of Aerospace & Mech Science, *260 Crittenden Blvd., Rochester, New York* 14627

This theoretical project studies the behavior of plasma to determine the conditions under which instability sets in, and the effect of nonlinearities in saturating the growth. The nonlinear theory emphasizes the threshold regime where there are only one or a few unstable modes. Calculations of the saturated state are carried out in realistic geometry, and every attempt is made to make comparisons with laboratory experiments, so as to verify the validity of existing theory. Results can suggest stabilization techniques. The linear program has concentrated on evaluating the influence of various effects on plasma stability in Tokamak and other geometries for the parameter ranges relevant to present and future devices.

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SUPPORTED BY U.S. Dept. of Energy

4.0034, HIGH-TEMPERATURE ALLOY DEVELOPMENT AND VERIFICATION FOR SPACE AND TERRESTRIAL POWER SYSTEMS

A.C. Schaffhauser, U.S. Dept. of Energy, Metals & Ceramics Div., *Oak Ridge, Tennessee* 37830 (W-7405-ENG-26)

The purpose of this work is to develop and characterize metals and alloys for very-high-temperature radioisotope thermal energy sources for power systems used in spacecraft and terrestrial applications. Designs require strong corrosion-resistant alloys that are inert in contact with graphite and the isotope fuel at very high temperatures. The alloys function as fuel containers, and retain the fuel in impact situations. The alloys and metals most involved are noble metals such as iridium, platinum, rhodium, and ruthenium. Alloys similar to commercial superalloys have been discovered that show significant advantages for large energy system applications. Full-scale hardware production to nuclear standards is an output of this program.

SUPPORTED BY U.S. Dept. of Energy

4.0035, DESIGN OF A TELEVISION INTERFRAME DELTA MODULATION SYSTEM

E.L. Hixson, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engin, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: A method for reducing the bandwidth for a down link TV system for the space shuttle was investigated. Redundant information was not sent and signal changes only were sent with a delta modulation system. A laboratory implementation was done for only 64 x 32 picture elements pre frame out of the 512 x 512 possible. Processing was digitally and signal changes were made in first steps. No live picture test was made.

SUPPORTED BY Lockheed Electronics Co. Inc.

4.0036, ANALYSIS OF AIRCRAFT SHELTERS SUBJECTED TO BLAST LOADING ENVIRONMENTS

W.D. Birchler, Braddock Dunn & McDonald Corp., *7915 Jones Branch Dr., McLean, Virginia* 22101 (DF190450; F29601-77-C-0056)

The objectives of the aircraft shelter analyses program will be to (1) analytically determine the transient responses of aircraft shelters b and c, of the dice throw event to specified blast waves using the structural analysis computer code NASTRAN, and (2) compare the analytical results with dice throw event test data and pretest calculations of Dr. Y. L. Wang and A. Chang. In addition, computational techniques and parameters will be identified which increase the accuracy between observed and calculated results.

Using the available information from the pretest calculations of the dice throw event, load models will be developed, which will be used in conjunction with structural models and the structural analysis code NASTRAN to determine the structural responses. The results of the NASTRAN code will be analyzed and compared to the pretest calculations and the dice throw data, and the results will be documented in a final report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0037, DEVELOPMENT OF DEPLOYABLE MULTIPARAMETER WATER MONITORING SENSOR/SAMPLER SYSTEM

D. Thomas, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Langley Research Center, *Hampton, Virginia* 23665 (D6-0053; J620A-33)

OBJECTIVE/APPROACH: Develop an air-deployable multiparameter water monitoring sensor/sampler system that is modular in design, can accept off-the-shelf sensors, and capable of unattended operation. Design, fabrication, and testing is being conducted through an IAG with NASA-Langley.

FINAL OUTPUT: A tested air-deployable multiparameter sensor/sampler system and a report describing the system will be used by EPA research and monitoring personnel.

RESULTS TO DATE: Sensors, sampler, anchoring system, and memory have all been bench-tested. Assembly into computer system is underway with completion estimated by October 1978. Testing and demonstration of the system is planned for fall 1978 through early summer of 1979. The estimated publication data of the project report is December 1979.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, TVA SUPPORT TO EPA FOR SULFUR TRANSFORMATION AND TRANSPORT IN ENVIRONMENT (STATE)

J.F. Meagher, U.S. Tennessee Valley Authority, Div. of Environmental Planning, Air Quality Research Section, *Muscle Shoals, Alabama* 35660 (D8-E721-DL; V625B-63)

The objectives of this program were to provide the necessary meteorological support for the field personnel working the STATE study, to provide an instrumented aircraft suitable for obtaining air samples for SF6 analysis, to provide field and coordination support at Cumberland Steam Plant for several other agencies involved in the study, and to measure several constituents in the flue gas. Four pibal stations, one dual and three mobile, provided data on wind speed and direction profiles whenever an experiment was in progress. Wind speed, wind direction, temperature, and dew point profiles were provided by radiosondes released at a nearby steam plant. A detailed up-to-date weather forecast was provided daily. Summaries of the meteorological conditions for each study day are being prepared. A deHavilland U6A, single engine airplane was equipped to measure SO2, altitude, and temperature. After installation of a system designed by NOAA, that collected air samples for SF6 analysis, this aircraft was used to locate the Cumberland plume and study its dispersion characteristics.

One secretary and seven drivers were provided for the support of other groups involved in the STATE study. The activities of all the agencies working at the plant site were coordinated, and plant operational data were provided. Coal samples were analyzed for percentage sulfur, ash content, and Btu content.

Tests of the flue gas were conducted to measure the following constituents: particle size distribution, O2, CO, CO2, and SO2.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

5.0002, OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES - R.U. 267

A.E. Belon, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (176 (NOAA/EAO No.))

OBJECTIVES: The principal objective of the project is to make remote-sensing data processing facilities and interpretation techniques available to OCSEAP investigators by: 1. The acquisition, cataloging and distribution of all available imagery. 2. The operation of a facility for photographic, optical and digital processing of remote-sensing data. 3. The development of photographic, optical and computer techniques for processing data. 4. The active interaction (including assistance in data search and processing) with all OCSEAP R.U.'s needing remote-sensing data and data analysis/interpretation assistance.

GENERAL STRATEGY AND APPROACH: Three basic approaches are followed in the performance of the project: 1. Search, acquisition, cataloging and dissemination (in Arctic Project Bulletins) of all relevant LANDSAT and NOAA satellite data, and aircraft remote-sensing data (USGS, NASA, NOAA, U.S. Army, etc.). 2. Development and adaptation of photographic, optical and computer methods for analyzing remote-sensing data, including contrast stretching, density slicing, color coding, and computer-aided physical and ecological classification of digital satellite data. 3. Applications of remote-sensing data to OCS studies in cooperation with other OCSEAP projects.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0003, MORPHOLOGY OF BEAUFORT, CHUKCHI AND BERING SEA NEAR SHORE ICE CONDITION BY MEANS OF SATELLITE AND AERIAL REMOTE SENSING - R.U. 257

W.J. Stringer, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (228 (NOAA/EAO No.))

OBJECTIVES: The overall objective of this study is to develop a comprehensive morphology of near shore ice conditions along the ice-frequented portions of the Beaufort, Chukchi and Bering Sea coasts of Alaska.

Specifically, this comprehensive morphology will include a synoptic picture of the development and extent of fast ice, the construction and location of pressure and shear ridges, the location and persistence of grounded ice features including ice islands, stamuki, ridges and hummock fields and the interrelationships among these phenomena.

The general assumption is that near shore sea ice behavioral patterns can be analyzed to yield some predictability in terms of offshore sea ice hazards to oil and gas development. As a result, geographical zones of different design and construction criteria as well as oil spill management plans can be established in the offshore areas taking into consideration the probability of damage to structures and problems encountered by clean-up operations due to adverse ice conditions. This should in turn allow the relative risk imposed to the adjacent ecosystems to be evaluated.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0004, JOINT DEVELOPMENT OF ALASKA DEMONSTRATION PROJECT

P.V. Krebs, University of Alaska, Fairbanks Campus, Graduate School, *Fairbanks, Alaska* 99701 (NCA 2-20901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0005, OPERATIONAL APPLICATIONS OF SATELLITE SNOW COVER OBSERVATIONS AND DCS OPERATIONS IN THE ARIZONA TEST SITE

H.H. Schumann, U.S. Dept. of the Interior, Geological Survey, Water Resources Division, *Phoenix, Arizona* 85025 (AZ 75-041)

The LANDSAT, NOAA, and SMS/GOES satellite imagery will be the primary source of repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds. These data will be supplemented by repetitive aerial surveys and supporting ground truth relayed by the ERTS DCS. The ERTS data collection platforms will relay hydrologic and meteorological data from key locations to aid in interpretation of the imagery and to demonstrate the ability of satellite telemetry systems to furnish timely and meaningful hydrologic information for use by water management.

A. To evaluate repetitive satellite imagery together with aerial surveys in an attempt to develop an operational capability in Arizona for using satellite imagery for mapping the distribution of snow cover on the Salt and Verde River watersheds. B. To develop techniques and procedures for systematic monitoring of snowcover and moisture conditions using remote sensor methods together with the use of the ERTS data collection system to relay ground truth data in near-real time.

The ERTS-1 and NOAA-2 imagery will be the primary source of repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds. These data will be supplemented by repetitive aerial surveys and supporting ground truth relayed by the ERTS DCS. The ERTS data collection platforms will relay hydrologic and meteorological data from key locations to aid in interpretation of the imagery and to demonstrate the ability of the relay system to furnish timely and meaningful hydrologic information for use by water management.

A technique for making snow-depth measurements using oblique aerial photography and snow markers has been developed. LANDSAT and SMS/GOES satellite data-collection systems (DCS) were used to collect data on streamflow rates and snow-water equivalents. Snow-covered area measurements have been made from selected LANDSAT, SMS/GOES, and NOAA satellite imagery taken between 1972 and 1977. Preliminary evaluations of snow-covered area measurements indicate that the rapid changes in snow cover over the Salt-Verde watershed seem to occur in consistent patterns and at relatively consistent rates.

Conduct additional aerial reconnaissance flights over the Salt-Verde watershed to collect information on snow depths. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0006, ENGINEERING SUPPORT TO THE WIDEFIELD PLANETARY DEVELOPMENT TEAM

Unknown, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (NAS 5-25484)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0007, HIGH-RESOLUTION COMPARATIVE OBSERVATIONS OF MICROWAVE AND HARD X-RAY SOURCES
H. Zirin, California Inst. of Technology, School of Engineering, Dept. of Astrophysics, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 5327)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0008, RESEARCH OF ACTIVE REGIONS ON THE SOLAR CONSTANT
G.A. Chapman, California State University & Colleges, California State University, Northridge Campus, Graduate School, *18111 Nordhoff St., Northridge, California* 91324 (NSG 5330)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0009, BROAD SPECTRUM OF MAGNETIC, VELOCITY AND SPECTRAL DATA
G.A. Chapman, California State University & Colleges, California State University, Northridge Campus, Graduate School, *18111 Nordhoff St., Northridge, California* 91324 (NSG 5333)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0010, ANALYSIS OF SOLAR MAXIMUM MISSION SPECTRAL INFORMATION
S.F. Martin, California State University & Colleges, California State University, Northridge Campus, Graduate School, *18111 Nordhoff St., Northridge, California* 91324 (NSG 5324)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0011, DEVELOPING AND IMPLEMENTATION OF AN INSTITUTIONAL MECHANISM FOR TRANSFER OF REMOTE SENSING TECHNOLOGY IN NORTHERN CALIFORNIA AS A TEST SITE
D.B. Hankins, California State University & Colleges, Humbolt State University, Graduate School, *Arcata, California* 95521 (NSG 7525)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0012, HIGH-ALTITUDE MONITORING ENVIRONMENTAL EFFECTS OF GEOTHERMAL ENERGY COAL STRIP MINING & OIL SHALE ACTIVITIES (ABBREV)
M.A. Knutson, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, Airborne Missions & Applications Div., *Moffett Field, California* 94035 (D7-E771-ELB; V625C-72)

The objective of this effort is to evaluate the application of high-altitude and low-altitude photographic and multispectral remote sensing to the determination of the potential and actual environmental effects of geothermal, coal strip mining and oil shale energy resource development.

The effort utilizes existing sensors onboard the NASA U-2 aircraft based at Ames Research Center and existing photographic cameras and multispectral scanner on board a low-altitude aircraft.

Results to date indicate that high-altitude color infrared photography can be used to provide an accurate environmental information base for energy resource development over areas as large as the entire Northern Great Plains. Low-altitude multispectral imagery over geothermal sites has shown that vegetative and thermal baseline data can be obtained for future change detection.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

5.0013, CORONAL NON-THERMAL PROCESSES
H.S. Hudson, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NSG 5321)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0014, SOLAR ANALYSIS OF THE SOLAR-CONSTANT MONITORING PACKAGE
H.S. Hudson, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NSG 5322)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0015, REMOTE SENSING SURFACE TRUTH CRUISE OF THE NEW HORIZON
Unknown, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NAS 5-25450)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0016, MICROWAVE RAIN SENSING
D. Hogg, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA72943)

PROJECT OBJECTIVE: Design, construction and operation of remote-sensing microwave systems that continuously and reliably monitor rain rate over an area of the earth.

CURRENT YEAR PLAN: To complete construction of a prototype 9.5 GHz transmission system for flash-flood warning, and for providing ground truth for weather radar and satellite sensors; to pursue design of a microwave radiometric flash-flood warning system.

PROGRESS REPORT: Critical components and basic elements such as the non-contacting microwave switch, two corner reflectors, and the duplexer have been tested; design and construction of the electronics is near completion; locations in the Boulder watershed have been chosen, and arrangements made with local officials.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0017, X-BAND DOPPLER
Liedtke, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8G120379)

PROJECT OBJECTIVE: Modify and test an x-band radar for meteorological measurements from an airborne platform.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0018, INTERNATIONAL MAGNETOSPHERE STUDY IONOSONDE OPERATIONS
K. Davies, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., Space Environment Lab., *Boulder, Colorado* 80302 (ATM78-17301)

In 1975, the Aeronomy Program of the National Science Foundation funded hardware costs for the development of a prototype modern digital HF radar (ATM75-23574). The Space

Environment Research Laboratory (SEL, Boulder, Colorado) of NOAA's Environmental Research Laboratories undertook the development, supplying all labor costs. The HF Radar consists of a 20 kW (peak pulse power) transmitter operating from 100 kHz to 30 MHz, a parallel pair of receivers, a mini-computer for overall system control and data processing, two special-purpose micro-processors (one for timing; the other for fast initial data handling), and peripherals (two 5 Megabyte disks, tape drive, graphics displays, etc.). By leaving all possible system parameters under software, rather than hardware, control and great versatility are achieved. (Considerable interest has been shown in this design, and SEL has agreed to build five more units: two with hardware funded by NSF (one for Utah State University/Stanford University; the other for SEL), one for the Max-Planck Institute for Aeronomy in Lindau, one for the Army's Atmospheric Research Laboratory at White Sands, N.M., and one for the British Antarctic Survey.)

This grant funds the development of this radar for use by the scientific community, particularly for support of the International Magnetosphere Study program. The scientific problems addressed are primarily high latitude and transport at various ionospheric altitudes.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0019, AIRBORNE MEASUREMENTS OF MINOR GAS CONSTITUENTS OF THE STRATOSPHERE
Unknown, University of Denver, Graduate School, *2115 S. University Blvd., Denver, Colorado* 80210 (NAS 2-10158)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0020, ESTUARINE HYDROLOGY OF TAMPA BAY
C.R. Goodwin, U.S. Dept. of the Interior, Geological Survey, Water Resources Division, *Tampa, Florida* 33602 (FL 71-159)

The hydrologic impact which a major dredging project may have on Tampa Bay, Florida needs to be investigated. Unanswered questions exist concerning possible changes in circulation patterns and the associated long-term effect on water quality. Shorter-term impacts on water quality during construction are also largely unknown.

The objectives include gaining a better understanding of the present physical and chemical characteristics of the bay and prediction of how these characteristics may change after project construction. Detection and measurement of short-term water quality impacts during construction is also an objective of the study.

An understanding of present bay conditions will be gained through collection, analysis and interpretation of a wide range of data, including: tide, water velocity, water quality, sediment quality, bottom configuration and sub-bottom material. Predicted changes in circulation will be made using a sophisticated, two-dimensional digital model. Possible water quality changes will be inferred from bay flushing information from the circulation model. Remote and direct sensing of dredge plumes using satellite imagery, aerial photography and standard water sampling techniques will be used during construction.

Circulation modeling of several proposed spoil-island placement alternatives.

Additional calibration, verification and predictive use of the Tampa Bay digital model is planned in addition to development of a smaller-scale model of Hillsborough Bay. Monitoring of dredge turbidity plumes and water-quality is also planned. Reports on modeling and monitoring phases of the investigation will also be prepared.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0021, IN SITU MEASUREMENTS OF OPTICAL PROPERTIES OF STRATOSPHERIC AEROSOLS USING NASA U-2 AIRCRAFT
G.W. Grams, Georgia Inst. of Technology, School of Geophysical Sciences, *Atlanta, Georgia* 30332 (NSG 2363)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0022, COMPARATIVE ANALYSIS OF TERRESTRIAL AND MARTIAN LABYRINTH TERRAINS
Unknown, University of Georgia, Graduate School, *Athens, Georgia* 30601 (NSG 7539)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0023, GLOBAL ATMOSPHERIC RESEARCH PROGRAM APPLICATIONS OF GLOBAL DATA SETS
Unknown, University of Hawaii System, Manoa Campus, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (NAS 5-25376)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0024, INVESTIGATION OF FLARE PROTONS IN THE SUN'S ATMOSPHERE
F.Q. Orrall, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *2444 Dole St., Honolulu, Hawaii* 96822 (NSG 5326)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0025, THEORETICAL STUDIES OF THE SOLAR CORONA, SOLAR MAXIMUM MISSION
T.C. Mouschovias, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (NSG 5319)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0026, GEOLOGIC MAP OF KUIPER QUADRANGLE OF MECUR
J.R. Underwood, Kansas State University, Graduate School, *Anderson Hall, Manhattan, Kansas* 66502 (NSG 7478)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0027, FOREST VOLUME TABLES USING AERIAL PHOTOGRAPHY
T.B. Brann, University of Maine, Orono Campus, School of Forest Resources, McIntire Stennis Program, *302 Boardman Hall, Orono, Maine* 04473 (0074826; ME09616)

OBJECTIVE: Adapt existing Volume Tables for Maine to reflect current merchantable use of trees. Develop volume tables based on aerial photography techniques.

APPROACH: Volume tables for commercial species will be constructed for tree diameter classes of 1 to 40 inches, and utilization limits as small as 1 inch. Volume tables will be correlated with aerial photograph measurements to provide aerial volume tables for Maine cover types. Optical dendrometry measurement techniques will be used to obtain data describing stem form for each species under study. Tree taper functions will be developed using current statistical techniques. Volume tables to any minimum diameter limit will be generated using the above taper functions. Application of aerial photograph measurement to classify stands by Diameter class, height class and volume class. Intensive ground verification will be correlated with photograph measurements during the aerial volume table development process.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Maine

5.0028, GROUND-BASED SOLAR RADIO OBSERVATIONS - SOLAR MAXIMUM MISSION

M.R. Kundu, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NSG 5320)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0029, ENGINEERING SUPPORT SERVICES TO THE WIDE-FIELD PLANETARY CAMERA DEVELOPMENT TEAM

Unknown, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NAS 5-25486)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0030, VARIATION OF THE SOLAR ULTRAVIOLET LUMINOSITY

S.P. Worden, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582550)

AF function - communication, surveillance, detection, tracking. Opportunity - to determine factors which influence long-range weather patterns and atmospheric conditions. Objective - to determine whether the sun varies its ultraviolet luminosity by more than .1 percent over the course of a year. How research contributes - changes in solar ultraviolet luminosity may be the major factor influencing long-range weather patterns as well as upper atmospheric ionization conditions. If such changes can be observed and predicted, Air Force long-range prediction capabilities in these areas may be greatly increased.

Because there is no suitable comparison source against which to directly observe changes in the solar ultraviolet luminosity, we will use sunlight reflected off objects in the outer solar system such as the moons of Saturn. These will be compared against stellar standards to determine variability. We will use the Cloudcroft, New Mexico 48-inch photometric telescope for this purpose. The National Science Foundation will operate this telescope for one year to do this study. We have chosen outer solar system objects both with atmospheres, such as Saturn's moon Titan, and without atmospheres, such as Saturn's moon Rhea. We feel we can obtain .1 percent accuracy in our measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, FORMATION OF ATMOSPHERIC AEROSOLS

K.T. Whitby, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Mech Engin, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (R803851-03; G603A-AH-03)

Aerosol size distributions have been measured in the St. Louis area as part of EPA's Project MISTT using aircraft and ground-based self-contained mobile laboratories. The University of Minnesota's portion of the project included aerosol measurements aboard an aircraft and the operation of a mobile van on the ground under the plumes.

The past year was devoted primarily to data analysis, the development of new analysis techniques and reporting results of aerosols data obtained over the past several years in Project MISTT and the Roadway Aerosol Study.

During the coming year the Particle Technology Laboratory of the University of Minnesota will be measuring aerosol size distribution for EPA's Project STATE (Sulfur Transport and Transformation in the Environment) in Tennessee and for EPA's Project SCRUB in Alabama and Minnesota. The STATE Program is directed to describing reactions and atmospheric processes affecting plume behavior over time scales of 12-96 hours and distances out to 1000 km. By contrast the SCRUB program will provide an assessment of the transport and transformation occurring within a power plant plume with an SO2 scrubber out to distances of about 1000 km and travel times mostly less than 12 hours.

Resources will be provided to complete data analysis and report on Project MISTT and to participate in the planning of Project SCRUB and the subsequent data analysis. Other tasks include the measurement of gaseous and aerosol pollutants under and in plumes being characterized in Project STATE and development of an aerosol mobility chromatograph to determine molecular composition of sulfur-containing aerosols.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0032, INSTRUMENTATION DEVELOPMENT FOR HYDROLOGIC DATA COLLECTION

F.C. Koopman, U.S. Dept. of the Interior, Geological Survey, Water Resources Division, *Bay St. Louis, Mississippi* 39520 (SR 54-013)

New developments in equipment and instrumentation suitable for use in water resources investigations, surveys and research need to be evaluated. Advances in electrical, electronic, and mechanical devices and components should be investigated.

Instruments or systems needed for WRD data collection are usually very specialized and so limited in number that industry enthusiasm and accomplishment fails to satisfy these needs. Therefore it is the objective of this project to design devices and systems which satisfy field requirements for new, special or improved instrumentation

The technology developed for each project or device is open for group and individual review prior to final method selection. After this selection maximum emphasis is directed toward operational reliability with minimum visitation and maintenance. Both method selection and development decisions are governed by practical techniques for accuracy, power conservation, longevity and overall economy.

Fifty-seven water quality monitors (WQM) were tested and distributed. Fifteen units were designed and assembled to interface with a magnetic-flow meter for recording flow on a digital recorder. A mini-servo control unit was designed and proven reliable for production. A current meter digitizer for replacement of earphones and stopwatch was prototyped and ten experimental units furnished to districts. Two systems were built for the Ohio River locks and dams for monitoring flow controls. Calibrations and repairs were made on 300 meters. Maintenance was conducted for the satellite relay program. The Denver Training Center was assisted. The laboratory maintained liaison with agencies and commercial concerns on hydrologic instrumentation.

Design, assemble and install flow-through monitor systems. Investigate, develop, design and improve signal conditioning circuits for interfacing hydrologic sensors to recorders. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0033, REGIONAL AIR POLLUTION STUDY - NETWORK OPERATION AND GENERAL SUPPORT

R.L. Myers, Rockwell International Corp., Air Monitoring Center, *11640 Admin. Dr., St. Louis, Missouri* 63141 (68-02-2093; G603A-AA-03)

This is the prime contract for the field phase of the Regional Air Pollution Study (RAPS) conducted in the St. Louis Air Quality Control Region beginning in 1973, and consists of three components. The Regional Air Monitoring System (RAMS) component is for collection of continuous aerometric data from a 25-station telemetering network. The Upper Air Sounding Network (UASN) component is for routine collection of meteorological data through the lower atmosphere at two to four sites. The Task Order component is for performance of a variety of related investigations supporting the RAPS.

The RAPS is a program for development and testing of regional-scale air quality simulation models. This contract effort provides the principal input to an extensive data base containing air quality, meteorological, and emission inventory data required for models, together with support for generally short-term, intensive studies of atmospheric processes determining transport, transformation, and removal of air pollutants.

Collection of data was completed in 1977, with data from the RAMS and the UASN, together with emission inventory data obtained principally through Task Order work entered in the RAPS Data Bank at Research Triangle Park, NC. Other Task Order work includes pollutant measurement and characterization, support of boundary layer studies, special winds aloft data to support transformation studies, material effects studies, investigations of instrumental responses, and quality assurance. Reports on all aspects of work are prepared as each aspect is completed, with those containing data or other results of interest published in the EPA-ORD report series.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0034, KINETIC ENERGY BUDGETS IN AREAS OF INTENSE CONVECTIONS

H.E. Fuelburg, St. Louis University, School of Arts & Sciences, Dept. of Meteorology, *221 N. Grand Blvd., St. Louis, Missouri* 63103 (NAS 8-33370)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0035, AIRBORNE LIDAR MEASUREMENTS OF PLUME STRUCTURE

D.N. McNelis, U.S. Environmental Protection Agency, *P.O. Box 15027, Las Vegas, Nevada* 89114 (G625B-EA-017)

A LIDAR unit mounted in an aircraft will be used to locate the plume and measure its shape and structure during Project STATE and Project SCRUB, summer 1978. It is particularly effective in locating plumes at night. Data collected will be used for calculating mass flow rates and for input to dispersion models.

Flights will be made in August 1978.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0036, TECHNICAL SUPPORT OF WATER QUALITY AND INTERDISCIPLINARY PROGRAMS

B. Landers, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., Remote Sensing Operations Br, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J613B-54)

OBJECTIVE/APPROACH: The objective of the technical support program is to provide research, developmental, documentary and environmental assessment support to Agency operating programs through application of state-of-the-art advanced and specialized monitoring techniques and systems. Technical support is provided to the requestors, to the extent that resources permit, so long as it has been specifically identified as supportive of Agency objectives, and is not otherwise available. The program gives priority to requested services which require unique ORD personnel or equipment and relative priorities among a given user's requests are established by that user.

FINAL OUTPUT: Technical support output is a continuing service of 1) responding to scheduled, unscheduled and emergency requirements for field, analytical, and data analysis support through specialized field and analytical studies, organizing these data into summaries and providing interpretive reports; 2) adapting and modifying state-of-the-art techniques to gather empirical evidence of environmental levels of specified or suspected pollutants; 3) performing complex chemical and physical analyses; 4) testifying as expert witnesses at adminstrative and judicial proceedings; and 5) consulting.

RESULTS TO DATE: Advancement of new-technology applications to Agency environmental investigative needs, particularly in the use of remote sensing technology through aircraft- and satellite-borne data collection systems, including multispectral scanning and laser systems.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0037, ENERGY-RELATED OVERHEAD MONITORING

G. Shelton, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., Remote Sensing Operations Br, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J625C-71)

OBJECTIVE/APPROACH: Establish preliminary guidelines for, and demonstrate overhead remote monitoring of, western energy related activities, including computer processing procedures for locating, mapping, and quantifying energy resource extraction activities. A NASA/EPA cooperative western energy monitoring program has been established to define, demonstrate, and develop operational remote sensor techniques to monitor, in a cost-effective manner, energy-related extraction site rehabilitation, including determination of environmental baselines for establishing rehabilitation criteria and environmental effects.

FINAL OUTPUT: A comprehensive summary report detailing the development and application of passive remote sensing technology for assessing the environmental impact of energy related activities.

RESULTS TO DATE: 1) Operational multispectral scanning data acquisition and digital data processing system for assessing environmental impact of energy related activities. 2) Publication of a joint EPA/NASA report, 'Western Energy Related Overhead Monitoring Project'. 3) Published research report, 'Guide to Preselection of Training Samples and Ground Truth Collection'.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0038, COLLABORATIVE RESEARCH OF SOLAR PHENOMENA - SOLAR MAXIMUM MISSION

L.A. Fisk, University System of New Hampshire, Graduate School, *Durham, New Hampshire* 03824 (NSG 5316)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0039, ANTENNA AND RADIOMETRIC LOSS MEASUREMENTS

K. Carver, New Mexico State University, Las Cruces Campus, School of Engineering, Dept. of Electrical Engineering, *University Park, Las Cruces, New Mexico* 88003 (NAS 9-95489)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0040, ANALYZE SIR-A ANTENNA TEST STUDY ANTENNA TEST

K.R. Carver, New Mexico State University, Las Cruces Campus, School of Engineering, Dept. of Electrical Engineering, *University Park, Las Cruces, New Mexico* 88003 (NAS 9-95487)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0041, MONITORING TROPICAL VEGETATION SUCCESSION WITH LANDSAT DATA

J.C. Coiner, City University of New York, Hunter Collge, Graduate School, *695 Park Ave., New York, New York* 10021 (NSG 5325)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0042, RUBIDIUM-STRONTIUM AGE STUDY PROTEROZOIC SHEAR BELTS IN WEST GREENLAND

N.K. Grant, Miami University, School of Arts & Sciences, Dept. of Geology, *Oxford, Ohio* 45056 (DPP77-23880)

Miami University of Ohio will continue investigation of the radiometric ages of Proterozoic shear belts of West Greenland. Field research in 1977 was carried out in cooperation with geologists from Great Britain and Denmark, without NSF support. Field work in 1978 will collect samples specifically chosen for rubidium-strontium age dating and determination of the thermal-tectonic histories of four major shear belts and the adjacent crustal blocks. The isotopic studies will be carried out in the geology laboratories of Miami University. The results of the isotopic studies of the samples will yield an age framework for the aerial geological and structural studies of a five-year joint project in the region by scientists from Great Britain and Denmark, sponsored by the Greenland Geological Survey.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0043, A CRITICAL EXPERIMENT TO SUPPORT POSSIBLE SPACE FLIGHT

A.E. Lord, Drexel University, School of Science, Dept. of Physics & Atmospheric Science, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NAS 8-33372)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0044, TEST OF THE LANDSAT-DATA COLLECTION SYSTEM IN THE SUSQUEHANNA RIVER BASIN

J.V. Funt, U.S. Dept. of the Interior, Geological Survey, Water Resources Division, *Harrisburg, Pennsylvania* 17104 (PA 73-051)

The potential use of earth orbiting satellite data relay systems for flood warning has not been well explored.

The objective of this project is to test the earth resources technology satellite-data collection system on key stream gages in the Susquehanna River Basin for flood warning.

Four data collection platforms will be field installed on stream gages in the basin. Data relayed from the gages will be provided to the Susquehanna River Basin Commission and the National Weather Service's River Forecast Center in Harrisburg.

Data collection platforms were installed at nine gaging stations in the Susquehanna River Basin for relaying data through the GOES satellite. Data collection platforms were operated at four gaging stations in the Susquehanna River Basin using the LANDSAT satellite to relay the data.

The operation of the LANDSAT data collection system will continue. The operation of the GOES data collection system will continue. In addition, four more GOES data collection platforms will be installed in the Susquehanna River Basin.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0045, CALIBRATION OF THE QUARTZ CRYSTAL MICROBALANCE CASCADE IMPACTOR (ABBREV)

N. Matthews, Le Moyne Owen College, Undergraduate School, Dept. of Education, *807 Walker Ave., Memphis, Tennessee* 38126 (NSG 1593)

Calibration of the Quartz Crystal Microbalance Cascade Impactor using the Berglund-Liu monodisperse aerosol generator for aerosol studies in the atmosphere.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0046, NIMBUS 6 CLOUD EVALUATION

K.N. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF581910; F19628-78-C-0130)

AF function - weather observation, analysis and forecasting. Deficiency or opportunity - limited ability to specify and forecast cloud conditions in real time. Objective - develop techniques to parameterize weather satellite microwave and infrared imagery data for the inference of cloud properties. How development contributes - a successful development will lead to improved cloud detection from satellites and improved input to cloud forecasting models.

For a variety of cloud conditions, radiances measured by the Nimbus 6 satellite will be compared to conventional sources of weather data. The observed radiances will also be compared to radiances calculated from a model of radiative transfer in cloudy atmospheres for ice and water clouds over a range of visibilities and thicknesses. Combinations of microwave and infrared channels which best identify cloud properties will be sought.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0047, SPECTRUM SYNTHESIS OF EXTREME ULTRAVIOLET SOLAR FLARE PROFILES

D.A. Tripp, Utah Higher Education System, Weber State College, Undergraduate School, Dept. of Physics, *3800 Harrison Blvd., Ogden, Utah* 84403 (NAS 8-33113)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0048, ICE DYNAMICS

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Division, *1305 Tacoma Ave. S., Tacoma, Washington* 98402 (WR 70-058)

The ice dynamics project is concerned with studying the motion of sea ice, glaciers, and ice caps and the way in which these systems interact with the atmosphere and oceans. Recent numerical modelling of the atmosphere and oceans reveals that the least understood part of the water and heat budget of the earth is that taking place in polar regions. Recent theoretical work also indicates that the arctic ice cover may be a meta-stable or unstable system. Russian and American development in the arctic necessitates intense study of the region to avoid inadvertent, irreversible changes of the arctic ice pack, glaciers, and oceans.

(1) To create numerical models of the arctic and antarctic ice covers and oceans for a variety of different rheological assumptions concerning the ice pack; (2) to acquire data to test the numerical models of the arctic ocean and ice pack and the antarctic oceans and ice pack by directly participating in remote sensing and surface-truth experiments and from remote sensing polar-orbiting satellites; (3) to construct multi-dimensional, time-dependent models of glacier flow and to test them with observations of glaciers made within the state of Washington by project personnel and glacier data from other investigators in other nations; (4) to construct numerical models of water flow within glacier and ice cap systems and to test these models with observations acquired from various glacier sites; (5) to study models of snow hydrology of alpine areas such as the North Cascades and Sierras.

The numerical models described above will be done using high-speed digital computers both within the Survey and at the U. of Washington. The field work in the polar regions will be done in direct cooperation with other agencies such as NASA, NOAA and DOE Canada, with whom the Ice Dynamics Project is in direct and intimate contact. This will include aircraft remote sensing using the NASA CV 990 airborne laboratory. Field work on glaciers will be done.

Ling continued work on an idea to replace the concept of eddy viscosity in fluid dynamics. A system for converting twice-daily antarctic surface pressure data to air stress data on sea ice has been completed for application to a numerical model to describe antarctic sea ice. A paper on the approximation of saturation vapor pressure has been completed by Rasmussen. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0049, GENERAL CIRCULATION STUDIES

J.M. Wallace, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (ATM78-07369)

This research is directed toward a deeper understanding of the atmospheric general circulation, which exerts a strong influence on the geographical and temporal variability of climate.

One major area of effort involves the geographical variability of the time averaged general circulation; as manifested in the so-called 'standing waves' which occur in response to longitudinal heating contracts and the uneven topography of the earth's surface. The time averaged jet streams and storm tracks occur in certain preferred positions relative to these standing wave patterns. These features will be investigated by means of observational studies based on long time series of synoptic maps, sea-surface temperature analyses and satellite imagery, together with theoretical studies based on a primitive equation spectral model.

The temporal variability of the general circulation will be the subject of a number of closely related observational studies which will focus on the frequency dependence and three-dimensional structure of natural climate fluctuations on time scales ranging from seasons out to about a decade. From such studies it is hoped a clearer understanding will be gained of the physical processes which control such variability. A number of feedback mechanisms will be considered which may contribute to short-term climatic variability. Major emphasis will be placed on interactions involving the temporal variability of sea surface temperature, cloudiness, and certain characteristics of the stratospheric circulation.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0050, DIRECT MEASUREMENT OF EXTINCTION BY STRATOSPHERIC AEROSOLS
R.J. Charlson, University of Washington, School of Engineering, Dept. of Civil Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (NSG 2362)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0051, ENGINEERING SUPPORT TO THE WIDE-FIELD PLANETARY DEVELOPMENT TEAM
Unknown, University of Wisconsin, Madison Campus, Graduate School, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 5-25487)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0052, OPERATE GOOSE BAY IONOSPHERIC OBSERVATORY
J. Kelsey, Canadian Commercial Corp., *Ottawa, Ontario, Canada* (DF582450; F19628-76-C-0072)

AF function - communications, surveillance and navigation at high latitudes. Deficiency - the disturbances of the high latitude or arctic ionosphere frequently cripple the above functions. Existing understanding is insufficient to predict disturbances and their impact. Ionospheric/auroral models which will allow routine operation of AF systems in this environment are still marginal. How research contributes - the geophysical data base provided by the contractor and enhanced data output obtained during coordinated aircraft/ground-based experiments are the basis for research advances in the areas of scintillation studies, monitoring of the state of the high-latitude ionosphere and modelling of the bottomside ionosphere. These efforts support satellite communications and all AWS users dealing with the high-latitude ionosphere and are important to the development of techniques to support CONUS OTH-B.

Contractor operation of ionospheric vertical and backscatter sounders, polarimeters, riometers and magnetometers provides the data for real-time support of AWS/GWC during night hours. These data, enhanced by data from an all-sky camera and from satellite receivers for scintillation measurements are sent to AFGL for scientific analysis. A system for the automatic pre-analysis of geophysical data will be evaluated and improved with the goal of total automation of real time data analysis. Operation of the station is enhanced during selected periods of airborne ionospheric studies of the arctic ionosphere and auroral effects on AF systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0053, WIND ENERGY MEASUREMENTS ON TOWERS
L.E. Olsson, Swedish Meteorological & Hydrological Inst., Climate Branch, *Norrkoping, Sweden* (53 5060 581)

The objective of the project is to collect wind speed data at heights which are relevant for wind power utilization.

Anemometers and temperature sensors will be installed on towers which are utilized for TV and broadcasting. Fourteen towers all over Sweden will be instrumented. The project is a continuation and an improvement of earlier wind energy prospecting, which included boundary layer estimations of the wind speed at heights up to 150 meters.

When the instruments are installed meteorologists will collect wind data. Power plant engineers, land use planners, energy production planners and wind power unit designers are intended to use the data when investigating how to introduce WECS into the Swedish electric supply system.

SUPPORTED BY Namnden for Energiproduktionforskning

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, CHARACTERIZATION OF SPACE ENVIRONMENT USING PLANT CELLS AND TISSUE
G.C. Sharma, Alabama Agricultural & Mechanical University, School of Agriculture, Dept. of Natural Resource & Environmental Studies, *Normal, Alabama* 35762 (NSG 8067)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0002, SMECTITE CLAYS IN MARS SOIL - EVIDENCE FOR THEIR PRESENCE AND ROLE IN VIKING BIOLOGY EXPERIMENTS
J.B. Orenberg, California State University & Colleges, San Francisco State University, School of Science, Dept. of Chemistry, *1600 Holloway Ave., San Francisco, California* 94132 (NSG 7512)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0003, CHARACTERIZATION OF NON-BONDING MOLECULAR COMPLEXES BY EMPIRICAL ENERGY METHODS COUPLED TO THE AMES GRAPHICS SYSTEM
G.H. Loew, Stanford University, School of Medicine, Dept. of Genetics, *Stanford, California* 94305 (NCA 2-745905)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0004, QUANTITATIVE ANALYSIS OF SELECTED BONE PARAMETERS
C. Arnaud, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NAS 2-10164)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0005, BONES AND JOINT DEVELOPMENT IN NEONATAL RATS
C. Arnaud, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NAS 2-10162)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0006, US/USSR RADIATION PROTECTION STUDIES
E.V. Benton, University of San Francisco, School of Science, Dept. of Physics, *2130 Fulton, San Francisco, California* 94117 (NAS 2-10161)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0007, DEVELOPMENT AND VALIDATION OF A FLIGHT SYSTEMS OPERATOR APTITUDE TEST
H.E. Jensen, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233630)

The objective of the research will be the development of an aptitude test to select trainees for the new flight systems operator (FSO) career field.

The effort will begin with an analysis of the tasks which are performed by the flight systems operator (FSO) to determine which abilities are important to the job. Tests measuring these abilities will be developed and assembled into a unified battery. Normative testing will then be conducted using personnel who are eligible for the FSO career field. Subjects who have taken the test battery will be tracked through training, with their training performance being correlated with test performance. Milestones - task analysis - 1 Apr 78 to 30 Jun 78, test design - 1 Jul 78 to 31 Oct 78, test norming and revision - 1 Nov 78 to 30 Jun 79, validation - 1 Jul 79 to 30 Jun 80 and documentation -1 Jul 80 to 31 Oct 80.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0008, OPERATIONAL LIMITS TO REPEATED EXPOSURE OF HIGH PLUS GZ ACM
J.W. Burns, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324130)

To determine if cardiovascular, specifically myocardial, injury results from exposure of miniature swine to operational levels of sustained and repeated plus gz similar to Air Force pilot exposures in high-performance fighter aircraft. If myocardial injury is observed, an effort will be made to define the injury and determine whether cardiovascular physiologic function is compromised.

Miniature swine will be chronically instrumented for the measurement of left ventricular function before, during, and after exposure to operational simulated air combat maneuver (SACM) acceleration profiles. The animals will be monitored systematically over a period of up to six months while being exposed three times per week to the operational SACM plus gz. A group of similarly instrumented control animals will be maintained and monitored for the same length of time to determine any influence the instrumentation may have on function.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0009, EFFECTS OF ANTI-G MEASURES ON GAS EXCHANGE
H.I. Modell, University of Washington, School of Medicine, Dept. of Physiology & Biophysics, *500 17th Ave., Seattle, Washington* 98122 (DF051920; F49620-78-C-0058)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including high sustained acceleration (HSG). It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance capabilities in aircrew members. Although information is available concerning physiological effects of moderate exposure to g (up to 5g), little information is available at higher levels of g exposure such as might be experienced during aerial combat maneuvers flown in the F-15 and F-16 high-performance aircraft. Deficiency - several questions remain to be answered relevant to high sustained g (HSG) tolerance if more effective protective measures are to be developed. This study will elucidate on the extent to which commonly used protective measures (e.g., anti-g suits, straining manuevers) enhance or impair ventilation-perfusion ratios and the development of atelectasis at 1 g and during exposure to HSG, the time course of gas exchange detriment resulting from use of these protective devices, the means by which these measures can be modified to optimize gas exchange during HSG. Objective - the overall objective of this research is to determine the extent to which commonly used anti-g measures enhance or impair gas exchange at 1 g and during exposure to HSG. How research contributes - this research will directly feed-in to ongoing exploratory development work conducted at USAFSAM and is covered under sub-area 1.6, 'Habitable Crew Environments in Air Force Operations.'

Animal experiments designed to examine changes in ventilation-perfusion distribution and atelectasis will be conducted at 1 g in the University of Washington laboratory and at HSG at USAFSAM. Protective measures to be examined include the anti-g suit abdominal bladder, positive pressure breathing, and the combined measures of anti-g suit abdominal bladder and positive pressure breathing. In addition to the experimental studies, the computer model of gas exchange presently under development for USAFSAM by Collins' study will be extended to include nonsteady state pulmonary gas exchange and effects of anti-g protective measures on ventilation-perfusion distribution and gas exchange.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0010, ORIGIN OF BACTERIA
W.M. Fitch, University of Wisconsin, Madison Campus, Medical School, Dept. of Physiology, *307 N. Charles St., Madison, Wisconsin* 53706 (NSG 7521)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, SOFTWARE PARTITIONING SCHEMES FOR ADVANCED SIMULATION COMPUTER SYSTEMS
A. Steinmetz, Teledyne Brown Engineering Co. Inc., *Cummings Research Park, Huntsville, Alabama* 35807 (DF228570; F33615-78-C-0013)

To develop design concepts for a technique, tailed to flight simulation problems, that will automatically divide a large software system into tasks that can be executed in parallel on multiple processor systems. The work will result in a set of guidelines for an automatic software partitioning scheme that can also identify interdependencies and communication links between tasks and determine methods of execution to prevent system deadlocks.

A complete simulator analysis will be conducted to determine the design goals and input/output parameters for a software partitioning technique. This includes an analysis of the hardware and software aspects of real-time flight training simulators to identify the factors which influence how the software should be partitioned. The basis for the software analysis will be a benchmark simulation problem to be supplied by the Air Force. The hardware analysis will be based on conceivable computer and peripheral configurations for simulation to be identified by the

contractor. Using this data, a set of design goals will be developed for a software partitioning technique. The input and output parameters necessary for this technique to achieve the design goals will be developed. The design of the software partitioning technique will then be developed to the point that it is automated to the maximum extent possible and can be demonstrated by hand. Simulator analysis, 8 MAC, develop model parameters, 10 MAC, algorithm development, 15 MAC, contract end, 18 MAC.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

7.0002, PROJECT RISK MANAGEMENT PACKAGE (PROMAP)
Unknown, Log An Inc., *924 Westwood Blvd., Los Angeles, California* 90024 (FA78WA-4109; FA161207 (TRAIS NO.))

The contractor shall install and maintain the PROMAP Program in the computer at the Department of Transportation Computer Center (TCC). The contractor shall have qualified personnel available on an 'on-call' basis for interpretation of PROMAP status reports and projections; analysis of alternative courses of action; evaluation of trends; control of schedule and budget; and implementation of final outputs. In the event the TCC computer is unable to meet abnormal turnaround dates, the contractor shall provide pick-up and computer processing of activity data on an 'on-call' basis for these non-routine updates.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0003, EMISSION LEVELS AND AIR QUALITY EFFECTS FROM NAVAL AIR STATION AIRCRAFT OPERATIONS AND TEST CELLS
D.W. Netzer, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* (DN898052)

(a) Develop and experimentally validate a computer model which can be used to assess the effects of engine operating conditions and turbojet test cell design on the flow field and engine exhaust distribution within the test cell, augmentor and exhaust stack, (b) experimentally determine the effects of test cell design and engine operating characteristics on pollutant concentrations in the exhaust stack, (c) develop an air quality assessment model for U.S. Navy operations.

(a) Adapt the Spalding PISTEP II and CHAMPION computer codes to the test cell geometry and operating conditions, (b) design, construct and utilize a 1/8-scale turbojet test cell to validate models and to determine optimum designs for pollution abatement, (c) modify the U.S. Air Force developed AQAM model to incorporate operations peculiar to U.S. Navy operations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

7.0004, THEORETICAL DEVELOPMENTS IN THE COMPUTATION OF THE ELECTRONIC PROPERTIES OF MOLECULES
G.A. Segal, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Chemistry, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 2351)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0005, CONDUCT TWO-PHASE ANALYSIS AND SPECIFICATION DEVELOPMENT EFFORT
Unknown, Information Planning Associates Inc., *656 Quince Orchard Rd., Gaithersburg, Maryland* 20760 (FA77WAI-803; FA161195 (TRAIS NO.))

The system evaluation shall be aimed at identifying problem areas in current test procedures at all levels of development and production considering existing constraints in support software and test facility equipments and their impact on the quality of the end product. These specifications shall provide both functional and design requirements in sufficient detail to allow their use as the basis for program development or in a competitive procurement. The format of these specifications shall be compatible with the existing terminal program computer program functional specifications and coding specifications.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0006, DEVELOPMENT OF MATHEMATICAL MODELS OF SPECIFIC CLOSED ECOSYSTEM FUNCTIONS
B. Moore, University System of New Hampshire, School of Technology, *James Hall, Durham, New Hampshire* 03824 (NCA 2-512901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0007, REAL-TIME IMAGE PROCESSING ALGORITHMS
G. Jarvis, Pattern Analysis Recognition Corp., *310 E. Chestnut St., Rome, New York* 13440 (DF911340; F30602-78-C-0105)

The objective of this effort will be to develop the required algorithms for application of real-time radar processing techniques in wideband image classification of unknown aircraft. This effort will determine the hardware sizing, applicable algorithms required and will demonstrate their feasibility. The requirement for positive identification of unknown high-speed tactical targets is a sensitive and critical need for air supremacy in a hostile environment. The development of real-time high-resolution data processing algorithms for aircraft identification via ground based tactical radars and applicable data processing systems will provide the necessary inputs to develop an effective real-time radar imaging system. Previous efforts by RADC have demonstrated the feasibility of real-time radar imagery. However, actual software development for the demonstration of real-time radar imagery has been restricted by motion compensation solutions, real-time data processing applications requirements of unknown targets.

The approach will include the development and implementation of the necessary algorithms to solve the motion compensation, cross range scaling problem for the real-time mini-configured system. This task may be solved by establishing a proficient intramodule communication/data flow which would effect serial/parallel processing with host/slave peripherals to obtain the high speed and computing power required to implement the algorithms for real-time imagery. Considerations of multi-sensor imputs which include bistatic radars, HUMINT, CLINT, IFF and their impact on the data processing task should also be evaluated. Identification of specialized peripheral hardware such as arithmetic array processors, high-speed data transfer discs and high-speed memories should be evaluated for effective implementation and trade-offs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, INFRARED ABSORPTION STUDIES OF CLOTHRATES AND HYDRATE ICES
U. Fink, University of Arizona, School of Liberal Arts, Dept. of Planetary Science, *Tucson, Arizona* 85721 (NCA 5-94)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0002, EXPERIMENTAL MEASUREMENTS OF F-VALUES NEEDED FOR STELLAR COMPOSITION DETERMINATIONS

G.D. Bell, Claremont Colleges, Harvey Mudd College, Undergraduate School, Dept. of Physics, *Claremont, California* 91711 (INT77,27204)

The Department of Physics at the University of Queensland, Brisbane, Australia, has recently established an intensive research program aimed at determining the relative abundances of elements in the sun and other stars. Such determinations are of great importance in opacity calculations and as experimental checks on theories concerning element synthesis, stellar evolution and the origin of the universe. Essential to this type of research is the accurate laboratory measurement of transition probabilities or oscillator strengths, known as f-values, which are needed to relate the strength of a spectral line to the concentration of the element producing the observed spectrum.

Drawing upon his expertise in the experimental measurement of absolute f-values for heavy elements, Dr. Bell will work for nine months with Dr. John E. Ross of the Queensland Physics Department who has concentrated on his research on determining solar abundances. Along with other colleagues in the department, the principal investigators will attempt to determine which f-values are most needed by astrophysicists for stellar abundance determinations and what methods might best be pursued to obtain improved measurements of those f-values.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

8.0003, SIMULTANEOUS SRS AND SHG IN LITHIUM IODATE

E.O. Amman, G T E Sylvania Inc., *Mountain View, California* (DF052450; F49620-78-C-0077)

AF function - this is an investigation in nonlinear optics concerned with the physical principles involved in the simultaneous generation of stimulated Raman scattering (SRS) and second harmonic generation (SHG). Such effects are important in doubling schemes used to generate new laser frequencies for AF applications. Opportunity - the need to have laser sources at additional wavelengths and to provide tunable sources for avionics applications increases the importance of having more fundamental knowledge of nonlinear optics. Objective -investigation of the interaction of two simultaneous nonlinear processes each of which occurs in the large-signal regime and the improvement of optical frequency conversion efficiency. Contribution - a key feature of this proposed program is the development of a Raman/SHG device that will operate at kHz pulse repetition rates. The results of the research should lend insight into the physical behavior of two simultaneous nonlinear processes that might occur in a single crystal.

This research involves an investigation in nonlinear optics concerned with the physical principles involved in the simultaneous generation of stimulated Raman scattering (SRS) and second harmonic generation (SHG). The basic device that would be used in these studies is a Raman oscillator consisting of a lithium iodate crystal placed inside a 1.08 micron pumping Nb-YAg laser. The first and second stokes outputs from this raman oscillator occur at wavelengths of approximately 1.18 microns and 1.31 microns, respectively. But lithium iodate, the raman medium, is also an established nonlinear optical medium. Thus one should be able to choose the lithium iodate crystal orientation such that phase-matched SHG of the first or second Stokes lines will occur thereby producing visible outputs at about 0.59 microns or 0.65 microns, respectively.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, ULTRA HIGH RESOLUTION MOLECULAR BEAM CARS SPECTROSCOPY WITH APPLICATIONS TO PLANETARY ATMOSPHERIC MOLECULES

R.L. Byer, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (NSG 2372)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0005, NUCLEAR MAGNETIC RESONANCE STUDIES OF MIXED-VALENT AND SUPERCONDUCTING RARE-EARTH COMPOUNDS

D.E. Maclaughlin, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Physics, *Riverside, California* 92502 (DMR78-10301)

A program of nuclear resonance and relaxation studies of rare-earth based intermetallic compounds will be carried out. Two main areas of research are included. The first involves investigations of mixed-valent compounds, in which the occupation of the rare-earth 4f shell fluctuates randomly in time. Nuclear Magnetic Resonance shift measurements in such systems will yield information on the hyperfine field at the nuclear site, and thereby on the nature of the 4f wave function; and spin-lattice relaxation studies will provide a measure of the spin fluctuation times associated with valence mixing. Systems to be studied include nearly integral-valent compounds which exhibit Kondo behavior (CeA12, CeA13); alloys in which composition variations permit either mixed- or integral-valent behavior (CeIn3-xSnx); heavy rare-earth compounds with a wide range of characteristic energies (CeIn3-xSnx); heavy rare-earth compounds with a wide range of characteristic energies (YbA12, Yba13); and a system with high low-temperature resistivity (SmB6). The second research area involves studies of Nuclear Magnetic Resonance parameters in the recently discovered rare-earth rhodium boride ternary compounds. Information on the mutual interaction between super-conductivity and magnetic order will be obtained, particularly on the effect of the superconducting transition on spin-spin interactions and critical behavior at the magnetic transition in ErRh4B4.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0006, MEASUREMENT OF VERTICAL CRUSTAL MOTION WITH SUPERCONDUCTING GRAVITOMETERS

J.M. Goodkind, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NSG 5331)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0007, THEORY OF THE INTERACTION OF INFRARED RADIATION WITH SOLIDS

M. Sparks, Xonics Inc., *Santa Monica, California* (DF052180; F49620-78-C-0042)

AF function - high-energy laser technology is finding wide application in future Air Force systems. Opportunity - both in the production of intense radiation and in the hardening of certain critical components to this radiation, the interactions of photons with matter is of extreme importance. Electrical breakdown in solids is an important basic problem because it is one of the simplest properties of solids that is not understood, and it is an important practical problem because optical and electrical breakdown limits the operation of so many electrical and optical devices. Objective - the general purpose of this research is to solve the fundamental problems of the interactions of infrared radiation with matter. More specifically, the objective is to establish a tenable theory of high-power laser damage to semiconductor and optical materials, and to compare the electron-avalanche breakdown process in dielectric materials with such other breakdown processes as multiphonon, tunneling, Raman, Brillouin, self-focusing, macroscopic-inclusion, and microscopic cluster-inclusion damage processes in order to determine under what conditions the electron-avalanche process dominates. The emphasis will be on infrared damage to semiconductor and optical materials. How work contributes - there is a high probability of solving the problem of explaining and predicting optical and electrical breakdown in solids. The impact of a successful theory would be two-fold. It would make a significant contribution to the theory of solids and it would be of practical importance to the operation and performance of high-power semiconductor and optical devices and allow the predetermination of whether window materials can be improved to increase their high-power laser damage threshold.

The approach to the solution of the electron-avalanche-breakdown problem will be first to describe a transport theory that incorporates such physical processes as the large-quantum processes - the photon-electron-phonon process, in which an electron is accelerated with the accompanying annihilation of a photon and the creation of annihilation of a phonon, and inter-conduction-band transitions - in addition to such previously considered processes as the Seitz lucky-electron process. Specific steps include checking the preliminary transport equation that does not include large-quantum processes solving the equation for a few selected cases. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0008, APPROACHING THE ULTIMATE VELOCIMETER - LASER TECHNIQUES FOR MEASURING MOLECULAR FLOWS

C.Y. She, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (NSG 1594)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0009, MEASUREMENT OF ATMOSPHERIC CONSTITUENT PROFILES USING THE SOLAR SPECTRUM AND THE ATMOSPHERIC EMISSION SPECTRUM IN THE INFRARED

D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM77-27633)

One of the major problems of the chemistry of the stratospheric ozone layer is the lack of data on the altitude distribution of many chemical species of interest. A significant number of molecules predicted to be present in the stratosphere and to play key roles in ozone chemistry have not been directly detected at all. Many such molecules have infrared absorption bands. The objective of this research is to detect and to determine altitude distributions of trace chemical species in the stratosphere in a series of balloon-borne experiments that utilize infrared absorption and emission as the basis for detection.

Two different types of instruments will be flown under this program: (1) a solar tracking system coupled to an infrared interferometer to obtain solar absorption spectra at a resolution of 0.01/cm as a function of altitude and from float altitude at sunset and (2) an ultrasensitive spectrometer system to measure radiation emitted by the atmosphere at various altitudes up to the balloon float altitude. Absorption studies offer superior spectral resolution for sensitive and accurate identification of the molecules present in the atmosphere. Emission experiments offer increased dynamic range and the ability to detect atmospheric species at any time of day and thereby measure important diurnal variation.

Previous balloon-borne infrared experiments have been highly successful in detecting many important stratospheric species for the first time. The substantially improved infrared absorption instrumentation to be flown under this grant shows considerable promise of achieving detection and measurement of several key species for which only upper limits on concentrations have been determined previously, thereby achieving a major improvement in chemical understanding of the stratosphere. The emission experiment should achieve significant results on the concentrations of important species, such as N_2O_5, that are believed to reach maximum concentration at night.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0010, RESEARCH ON RADIATION-INDUCED LASER PLASMAS

R.T. Schneider, State University System of Florida, University of Florida, Graduate School, *Gainesville, Florida* 32601 (NSG 1586)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0011, PROPERTIES OF NOBLE GAS CRYSTALS

R.O. Simmons, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (EY-76-C-02-1198)

Crystals of 3He and 4He show, in extreme fashion, quantum effects on characteristics such as defect excitation, self- and impurity-diffusion, and thermodynamic properties. In helium crystals the wavelengths associated with the atoms are comparable to interatomic distances. This project uses x-ray diffraction to study and to characterize these solids at temperatures down to 60 mK. For crystals of other molecules, various prototypical aspects are studied by optical and x-ray scattering and by other techniques. Examples are high-precision x-ray work on methane crystalline phase transitions, including isotope effects, work on ultralow temperature transitions in solid hydrogen, high-pressure studies of thermal vacancies, of melting, and of substitutional point defects in argon crystals.

BIBLIOGRAPHIC REFERENCES: B.A. Fraass, S.M. Heald and R.O. Simmons, Growth of Several Quantum Crystals: CD4, 4He and 3He, J. Cryst. Growth, 42, 370-375 (1977); S.M. Heald and R.O. Simmons, Cryostat for Precise X-ray Diffractometry of Crystalline Helium to 60 mK and 25 MPa, Rev. Sci. Instrum., 48, 316-319 (1977).

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0012, MICROSCOPIC THEORY OF NUCLEI, NUCLEAR, AND NEUTRON STAR MATTER

V.R. Pandharipande, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (PHY76-22147 A02)

Research in the microscopic theory of nuclei, nuclear and neutron star matter which was initiated under NSF grant PHY74-22148 A01 will be continued. Specific topics to be investigated include: 1) development of a variational theory for dense systems; nuclear and neutron star matter in particular, 2) a study of nucleon-nucleon (N-N) interaction models, 3) relativistic many-body systems, 4) a study of possible phases of matter at super-nuclear densities, 5) calculation of neutron star models and their observable properties, 6) microscopic calculation of the structure of finite nuclei.

The past two years have seen spectacular developments in the related experimental and observational fields. Masses of three compact sources believed to be neutron stars have been determined as about 1.4 M while the maximum mass supportable by a noninteracting neutron gas is only 0.7 M. Thus the predicted large influence of N-N interaction on the structure of neutron stars has been observed. A measurement of the moment of inertia of a 1.4 M neutron star within even 20% accuracy will give us direct and significant information on the equation of state of neutron star matter. One could hope that heavy-ion collision experiments may provide information about the equation of state of nuclear matter of high densities. A major aim of the present program is to theoretically calculate these equations of state.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0013, RESEARCH OF IMPULSE ELECTROMAGNETIC BURSTS - SOLAR MAXIMUM MISSION

D.S. Spicer, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NSG 5323)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0014, EXTENSION OF MULTICHANNEL QUANTUM DEFECT THEORY TO COMPLEX MULTILIMIT ELECTRONIC STRUCTURES

M.L. Ginter, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (PHY77-14953)

This is a combined theoretical and experimental study in atomic and molecular physics which will extend existing methods

for applying the current theoretical model (multichannel quantum defect theory) to include complex electronic structures (i.e., structures encountered in most real atomic and molecular problems) using extensive and highly resolved spectral data for Al, As, Sb, Bi and the elements in groups IIa and IV to critically test our results. For the quasi two-limit case we will determine (a) the practical limitations on MQDT parameterizations, (b) the relative contributions of angular momentum recoupling, configuration interactions, core polarization, etc. to specific channel structures, and (c) the relative compositions of the eigen states associated with channel structures in both the close and loose coupled regimes. For the quasi three- and four-limit cases we will determine (a) the suitability of graphical methods and (b) appropriate numerical substitutes to graphical approaches for application to systems with more than two limits. Appropriate experimental data aleady are in hand for Ca and the elements in group IV, while the remaining data will be obtained using existing instruments.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0015, NONLINEAR INTERACTIONS BETWEEN LASER RADIATION AND SPIN ALIGNED CARRIERS IN SEMICONDUCTORS

E.J. Johnson, General Telephone & Electronics Corp., Laboratories Inc, *40 Sylvan Rd., Waltham, Massachusetts* 02154 (DF052630; F49620-78-C-0082)

AF function - secure space communication and covert optical electronics require devices which exploit the properties and interaction effects of materials with infrared radiation. Opportunity - infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - there are five principal objectives in this research on semiconducting compounds: 1) to better understand details of the spin dynamics of recombining electron-hole pairs, 2) to study the spin dependence of optical transitions near the fundamental absorption edge, 3) determine the gain and polarization properties of lasers in the presence of spin alignment, 4) study the effects of optical spin alignment on the output of laser amplifiers using polarized injection signals, 5) investigate techniques for fast switching of the polarization of infrared signals using spin-dependent phenomena. How work contributes - it is expected that this work will lead to a powerful technique for fundamental studies of semiconductors for fine probing of spin-dependent optical transitions, for studying spin dynamics in the formation of various band-edge complexes and for influencing stimulated emission processes. Optical spin alignment has far-reaching implications for the technology of semiconductor lasers as infrared sources and signal processing devices that are needed for optical communications.

The general approach will be to examine the intensity and analyze the polarization of emitted radiation in photoluminescent experiments under a variety of conditions. In simple preliminary optical spin alignment (OSA) experiments, a bulk sample will be used and the exciting radiation of arbitrary frequency will be circularly polarized. In experiments designed for detailed probing of the fundamental absorption edge, the high-intensity tunable output of an infrared dye laser pumped with a cavity dumped krypton ion laser will be used as the source of exciting light. To study effects of spin alignment on stimulated emission, resonator structures are being developed for oscillator and amplifier applications. Using such resonators, the effect of polarized pumping and polarized injection signals on the intensity and polarization of the output emission will be studied. Techniques for fast switching of laser output will evolve from the study of OSA interactions in stimulated emission. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0016, NEUTRON SCATTERING STUDIES OF THE TRANSITION METAL SESQUIOXIDES

S.A. Werner, University of Missouri, Columbia Campus, Graduate School, *205 Jesse Hall, Columbia, Missouri* 65201 (DMR77-27247)

Neutron scattering experiments will be carried out at the University of Missouri Research Reactor to investigate the highly unusual magnetic and electronic properties of the vanadium and titanium oxides. Large single crystals suitable for neutron scattering experiments have been obtained and will be used in the following experiments: 1) Measurement of the phonon dispersion in V2O3 above and below the semiconductor-to-metal transition (170K). 2) Measurement of the magnon dispersion in V2O3 below the Neel temperature. 3) Measurement of the phonon dispersion in Ti2O3 as a function of temperature. 4) Measurements on chromium-doped V2O3 at temperatures where the speculated Mott transition occurs. 5) Measurements of the magnetic ordering in titanium doped V2O3 as a function of temperature.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0017, MAGNETISM AND PHONON PROPAGATION IN METALS AND AMORPHOUS MAGNETS

T.R. Carver, Princeton University, Graduate School, Dept. of Physics, *205 Nassau Hall, Princeton, New Jersey* 08540 (DMR78-15268)

Experimental research in the general area of magnetism and phonon interactions in condensed matter systems which previously was supported by NSF grant DMR-7618667 will be continued. The microwave magnetic resonance transmission techniques which were originally invented at Princeton will be developed further for studies of the critical exponents for the magnetic phase transitions in copper-nickel alloys and in iron. The studies will be done as a function of composition. Also, the technique will be used as a probe for magnetic phase transitions by a new method for generating and transmitting microwave phonons in the anomalous skin depth region of metals.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0018, TURBULENCE MEASUREMENTS IN HIGH-SPEED FLOWS BY RESONANT FLUORESCENCE

R.B. Miles, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (NSG 2366)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0019, THEORETICAL PARTICLE PHYSICS

J.B. Bronzan, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (PHY7821407)

Research will be done in theoretical physics to further our understanding of the elementary particles. Topics studied will include: 1) Strong coupling expansions in field theory, 2) Quantum chromodynamics and the dense quark gas, 3) A spin model analogue to Reggeon field theory, 4) New dual string models, 5) The approach to gravity known as 'supergravity', 6) 'Supersymmetric' field theories, possibly including ones which contain particles of spin 5/2, 7) Properties of theories containing massless quarks, 8) Consequences of various kinds of 'Higgs' particles, 9) Quark-quark scattering at low transverse momentum.

This is a continuation of research previously supported under NSF grant PHY-7624312A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0020, RELATIVISTIC EFFECTS IN ATOMS

M.H. Mittleman, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (NSG 5334)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0021, SUPERCONDUCTIVITY IN TRANSITION METAL SUBSTITUTED A-15 SYSTEMS

F.J. Cadieu, City University of New York, Queens College, School of Liberal Arts & Science, Dept. of Physics, *65-30 Kissena Blvd., Flushing, New York* 11367 (DMR78-03217)

This is a continuation of work sponsored under DMR74-18138.

The A-15 phase of compound systems of the form (Nb1-yTy)1-xGex), where T is the transition metal atom Mo, Ti or Zr, will be synthesized via RF sputtering techniques. Metallurgical characterization will be accomplished by the use of X-rays and X-ray fluorescence techniques. Superconducting state parameters such as Tc and dHc2/dT will be determined from AC inductance data. Such data will be correlated with composition and microstructure to delineate those physical parameters which maximize Tc. Auger and electron loss spectroscopy will be used to obtain information about the effect of T-atom substitution upon N(O), the electronic density of states evaluated at the Fermi level. This work is important to our basic understanding of high (greater than 18K) Tc superconductors and will impact on energy related problems via large scale applications of high Tc superconductors.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0022, EXPERIMENTAL STUDIES AT LOW TEMPERATURE

D.H. Douglass, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (DMR78-10260)

This is a continuation of work sponsored under DMR-7621622. An experimental study will be made of synthesis and properties of superconducting transition metal compounds. Studies will be made of sputtered transition metal carbides and of various chromium alloys. A new program will be initiated to study the properties of materials at low temperature. An experimental study of second sound in a single crystal of sapphire will be initiated. Measurement of internal friction in crystals of silicon and sapphire will be made. This work is important for understanding the process of synthesis of high-temperature superconducting materials.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0023, MILLIMETER AND SUBMILLIMETER SPECTROSCOPY OF MOLECULES ATMOSPHERIC IMPORTANCE

Unknown, Duke University, Graduate School, *Durham, North Carolina* 27706 (NSG 7540)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0024, MOLECULAR INTERACTIONS WITH MANY-BODY PERTURBATION THEORY

R.J. Bartlett, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF053020; AFOSR-78-3661)

AF function - this research contributes to RO 6.3, electromagnetic weaponry. Deficiency - more accurate and efficient methods for calculating potential energy hypersurfaces are needed. Objective -many-body perturbation theory will be adapted to the study of molecular interactions. Contribution - further understanding of intermolecular interaction phenomena will assist in the development of high-power lasers.

Research is directed toward developing new, efficient, and more accurate methods for first-principle quantum mechanical determinations of molecular interactions in order to determine parts of energy hypersurfaces for ground and excited states. Since a predictive theory of potential energy surfaces is required, the approach must exceed the Hartree-Fock self-consistent-field method in accuracy and must include correlation. The method being pursued is a natural extension of Hartree-Fock theory based upon the linked-cluster expansion and many-body perturbation theory. MBPT possesses advantages that make it attractive for the calculation of energy surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0025, SUPERCONDUCTING MAGNET FACILITY

R. Madey, Kent State University, School of Arts & Sciences, Dept. of Physics, *Hilltop Dr., Kent, Ohio* 44240 (DMR78-09046)

A superconducting magnet system is provided for a facility at Kent State University with NMR (nuclear magnetic resonance) and magnetic field capabilities (e.g. for orienting liquid crystals) far beyond those which now exist on campus or in the immediate region. The principal use of the facility is for the liquid crystal effort in the Department of Physics and the Liquid Crystal Institute. Other users will include members of other departments, such as chemistry, at Kent State and the Northeastern Ohio Universities College of Medicine.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0026, RADIATION PROBLEMS IN GENERAL RELATIVITY

A.I. Janis, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY78-13926)

Theoretical physics research will be done in the area of general relativity. The following is a brief summary of the main topics to be emphasized.

1) There will be continued study of the geometric properties of the four-complex dimensional space (H-space) of asymptotically shear-free null surfaces in asymptotically flat space-times and its relationship to twistor theory. Particular points to be worked on are: a) Generalization of the techniques to include Yang-Mills theory. b) To further explore the unusual theory of equations of motion (ponderomotive force laws) that seems to be emerging. c) To understand, more precisely, how to find the physical space which produced a given H-space. d) To find more explicit H-spaces. e) To study the wide class of two-dimensional real H-spaces. f) To generalize the Penrose twistor particle classification scheme to deformed twistor space. g) To study the use of hyperfunction theory and sheaf theory in the case of non-analytic solutions to field equations.

2) It is planned to study several aspects of angular momentum in general relativity. In particular these include the removal of the ambiguities in the definition of angular momentum and the difficult question of finding the relationship between the rotational motion of sources and the total angular momentum.

This work is a continuation of that currently supported under NSF grant PHY76-17253 AO1.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0027, ANALYTICAL SUPPORT OF HIGH-VOLTAGE SOLAR PANEL/SPACE PLASMA INTERACTIONS SIMULATION TEST IN CHAMBER A

J.W. Freeman, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NAS 9-15796)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0028, APPLIED PLASMA PHYSICS--FUSION PLASMA THEORY RESEARCH

W.E. Drummond, University of Texas, Austin Campus, Center for Plasma Physics & Thermonuclear Research, *200 W. 21st, Austin, Texas* 78712 (EY-76-C-05-4478)

The Fusion Research Center theoretical program is primarily directed toward understanding the heating and confinement of plasmas in a Tokamak configuration. A broad program of confinement studies applicable to the national program of Tokamak research has been continuing for several years. These studies in-

clude the theory of MHD equilibrium and stability in magnetic configurations, neoclassical transport, microinstabilities driven by the current and gradients in density and temperature, anomalous transport produced by these instabilities, and instabilities caused by the presence of high-energy particles, such as runaways or beams. Our goal is to understand each feature which may contribute to the heating and subsequent decay of the plasma, and finally, to combine these features into a unified description of the time evolution. In the next few years, as the TEXT and PRETEXT experimental programs get under way, we will turn our efforts increasingly toward the interpretation of observed phenomena in these Tokamaks, and, at the same time, continue to pay close attention to the development of analytic and numerical methods for dealing with the underlying plasma processes.

SUPPORTED BY U.S. Dept. of Energy

8.0029, STUDIES OF NEW MEDIA FOR RADIATION-INDUCED LASERS
K.S. Han, Hampton Inst., Graduate School, Dept. of Physics, *Hampton, Virginia* 23368 (NSG 1595)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, A LABORATORY STUDY OF SILICATE CONDENSATION
K.L. Day, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST78-11306)

Laboratory apparatus for studying aspects of silicate condensation from two different approaches has been constructed. One set of experiments explores the complexities of the nucleation process when silicates nucleate from a mixture of SiO and Mg vapors. The other experiments study surface condensation of silicates as thin films from the vapor state. Both these approaches are yielding data which are of use to astronomers and cosmochemists interested in primordial condensation.

It is hoped to further quantify the results, obtain optical constants for materials likely to form in space, and expand the experiments to more complex systems which more closely approximate astrophysical conditions.

This research was supported under grant AST 76-21385.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, STUDY OF SUPERNOVA REMNANT RCW 103 AND A SEARCH FOR X-RAY EMISSION FROM DWARF NOVAE
G.P. Garmine, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAS 8-33331)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0003, ANALYSIS OF TIME-DEPENDENT H-ALPHA FLARE SPECTRA
J.L. Kulander, Lockheed Missiles & Space Co. Inc., *3251 Hanover St., Palo Alto, California* 94304 (ATM78-06276)

Perhaps the most extensive set of hydrogen-alpha line profiles from solar flares ever taken was obtained at the Lockheed Solar Observatory from 1972 to 1974. A large number of flare events were observed in their entirety, both near the center of the solar disc and near the limb at 15-second intervals.

The observed line profiles are highly asymmetric due primarily to the large velocities present in the flare. This grant will support a study to determine the velocity and other physical parameters as a function of time at different positions within flares and for several types of flares. This will be done by generating theoretical line profiles to compare with the observed profiles.

The velocity profiles derived from the data will be compared with those predicted by various theoretical flare models in an effort to determine the appropriate flare mechanism. Electron temperatures and flare optical thicknesses will also be used to select a flare model.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0004, A BALLOON-BORNE HIGH-RESOLUTION X- AND GAMMA-RAY SPECTROMETER
Unknown, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (NSG 7527)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0005, RESEARCH INTO THE THEORY OF STELLAR STRUCTURE AND EVOLUTION
R.K. Ulrich, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (AST78-20236)

The structure and evolution of stars will be studied both observationally and theoretically by utilizing a variety of new diagnostic techniques. The areas of concentration will be 1) solar structure as deduced from global oscillations and solar neutrinos, 2) the evolution of pre-main sequence stars as influenced by surrounding gas, 3) the structure and evolution of interacting binary systems. Along with considerations of solar neutrinos, the diagnostic techniques rely primarily on the theory and observation of gas motions within or near the star. The study of solar structure may permit a model of the sun which is more thoroughly tested than was previously possible. The study of pre-main sequence stars should allow a more complete understanding of how the gas in a pre-stellar cloud interacts with the forming star. The study of interacting binaries should permit a better understanding of accretion disks which are postulated to exist near black holes.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, THEORETICAL STUDIES IN GAMMA RAY LINE ASTRONOMY
Unknown, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NSG 7541)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0007, A SPECTROPOLARIMETER FOR THE LICK OBSERVATORY IMAGE TUBE SCANNER
J.P. Miller, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy, *Santa Cruz, California* 95060 (AST78-19753)

The image tube scanner (ITS) of the Lick Observatory 120-inch Shane reflector is a highly productive instrument. It is used to obtain flux-calibrated spectra of astronomical objects. This grant will provide funds to support the addition of a polarimeter to the image tube scanner. The polarimeter will make it possible to simultaneously measure the polarization in both the sky and object at the full spectral resolution of the image tube scanner, making the device the only one of its kind on a large telescope. With this polarimeter it will be possible to make highly accurate polarization measurements with system noise reduced to an extremely low level. The instrument will be made available to all users of the 120-inch telescope. It will be used for research on quasi-stellar objects, Seyfert galaxies and related objects.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0008, A COORDINATED X-RAY AND ULTRAVIOLET STUDY OF STELLAR CORONAE, TRANSITION REGIONS AND CHROMOSPHERES
T.A. Ayres, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NAS 8-33342)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0009, A COORDINATED X-RAY OPTICAL AND MICROWAVE STUDY OF THE FLARE STARS PROXIMA CENTAURI, YZ CANIS MINORIS AND UV CETI
Unknown, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NAS 8-33333)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0010, SOFT X-RAY SPECTROSCOPY OF HERCULES X-1
R.A. McCray, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAS 8-33338)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0011, RADIO ASTRONOMICAL STUDIES OF THE SOLAR SYSTEM
J.W. Warwick, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (AST76-81577 A01)

The University of Colorado group will examine the radio emissions from the sun and planets in the meter and decameter wavelength range. Observations of Jupiter will be emphasized during the period when the two Voyager spacecraft are near that planet, to maximize the potential for a better description of the complex radio emissions and for an understanding of the underlying physical mechanism.

A compressive receiver designed and constructed under prior support will be used with antennas at the Colorado Radio Astronomy Observatory near Nederland, Colorado to: 1) Obtain high-speed radio spectral observations of the solar and Jupiter radio emissions (frequency range: 1 to 80 MHz; bandwidth: 50 KHz; minimum time per spectrum: 100 microsecs; mode: interferometer or polarimeter; poorest detectable flux density: the galactic flux density). 2) Analyze these data alongside in situ observations from the Voyager spacecraft encountering Jupiter in March and July, 1979.

Prior support was by NSF grant AST 76-81577.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, NUMERICAL EXPERIMENTS IN GALACTIC DYNAMICS AND PLANETARY FORMATION
R.H. Miller, University of Chicago, School of Physical Sciences, Dept. of Astronomy, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (NCA 2-108902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0013, SUPERNOVA REMNANTS NEAR COS-B GAMMA RAY SOURCES
R.C. Lamb, Iowa State University of Science & Technology, College of Humanities & Sciences, Dept. of Physics, *Beardshear Hall, Ames, Iowa* 50010 (NAS 8-33334)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0014, RADIO AND OPTICAL STUDIES OF X-RAY CLUSTERS OF GALAXIES
W.C. Erickson, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAS 8-33346)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0015, HEAO-B OBSERVATIONS OF DISTANT QSO ASSOCIATED CLUSTERS OF GALAXIES
J.S. Scott, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAS 8-33329)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0016, INTERNATIONAL SUN-EARTH EXPLORER 3 DATA INTERPRETATION SERVICES
M.A. Coplan, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (NAS 5-25472)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0017, AXISYMMETRIC SOLAR WIND THEORY
R.L. Carovillano, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (ATM77-11690 A01)

This grant will support a study of axisymmetric solar wind theory. The basis for the work is a new equation governing axisymmetric ideal magnetohydrodynamic (MHD) flow. The purpose of the work is to extend the analysis of the equation, to obtain analytical solutions, and to develop applications to the solar wind. Areas to be studied include: critical surfaces, mathematical properties of the equation and its solutions, analytical solutions, the variational principle from which the equation is derivable, perturbation theory, propagation of disturbances, the relativistic generalizaton of the equation, and applications to solar research such as coronal holes and the heliosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0018, THEORETICAL INVESTIGATIONS OF THE REMNANT NEBULAE OF SUPERNOVAE
W.C. Straka, Jackson State University, Graduate School, *1365 Lynch St., Jackson, Mississippi* 39217 (RIM78-16987)

This project will be an investigation of several of the basic assumptions usually made in theoretical models of supernovae remnants. Comparisons will be made between the theoretical models and recent observational data as obtained by visual, radio, infrared, and X-ray astronomical observations. The particular problems are: 1) the initial ionization of the medium surrounding the supernova outburst as the remnant and shock move into it; 2) the formation of filaments; and 3) the radiation to be expected from the remnant at various stages.

The approach to be used will be the application of recently developed two-dimensional hydrodynamic computer programs to a variety of initial conditions. Part I will examine numerically inhomogeneities in the interstellar medium and flow under a variety of conditions.

These results will advance the understanding of the structure and evolution of the interstellar medium and an important stage in the life of a star. It has been suggested that supernova shocks trigger star formation. These calculations should shed light on that question.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0019, RESEARCH ON CHROMOSPHERES OF CLASSICAL CEPHEIDS
E.G. Schmidt, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (NSG 5332)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0020, INVESTIGATE ACCRETION FLOWS IN THE PERSEUS CLUSTER GALAXIES
L.L. Cowie, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (NAS 8-33345)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0021, OPTICAL PHOTOMETRY AND AREA SPECTROPHOTOMETRY
J.G. Duthie, University of Rochester, School of Arts & Sciences, Dept. of Physics, *260 Crittenden Blvd., Rochester, New York* 14627 (NAS 8-33328)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0022, MOBILE TELEMETRY TRACKING SYSTEMS
Unknown, Oklahoma State University, Graduate School, *211-215 Whitehurst Hall, Stillwater, Oklahoma* 74075 (NAS 6-2970)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0023, OBSERVATIONS OF THE RAPID VARIABLE AE AQUARIUS IN THE HEAO-B GUEST INVESTIGATOR PROGRAM - OBSERVATIONS OF SELECTED SUPERCLUSTERS
G.L. Chincarini, University of Oklahoma, Norman Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (NAS 8-33330)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0024, STUDIES OF SOLAR-TERRESTRIAL RELATIONSHIPS AS MANIFESTED BY COSMIC RAY INTENSITY
M.A. Pomerantz, Franklin Inst. of the State of Pennsylvania, *20th & Benjamin Franklin Pkwy., Philadelphia, Pennsylvania* 19103 (ATM77-12615 A01)

This grant supports investigations of a variety of solar-controlled phenomena by analyses of cosmic-ray data recorded by ground-based detectors in conjunction with related solar and interplanetary observations. The work will focus on the unique potential of observations of modulations, anisotropies, and the flow patterns of relativistic cosmic rays for deducing critical information regarding large-scale electrodynamic properties of the solar atmosphere from the sun's immediate vicinity to the outer heliosphere. The principal objective is to study already available and forthcoming experimental results in order to further test, refine, and develop theoretical models of the physical mechanisms that give rise to transient and long-term intensity variations, radial and perpendicular gradients, three-dimensional anisotropies, periodic waves, and scintillations of galactic cosmic rays, and acceleration, coronal transport, injection, and interplanetary propagation of relativistic solar cosmic rays. Provision for the continued operation, during the impending period of increasing solar activity, of the Thule neutron monitor, which is a source of crucial data for all of these studies, will be made.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0025, SIMULTANEOUS X-RAY AND RADIO OBSERVATIONS OF EXTRAGALACTIC SOURCES
B.S. Shen, University of Pennsylvania, Graduate School, *203 Logan Hall, Philadelphia, Pennsylvania* 19104 (NAS 8-33336)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0026, STATISTICS OF SPECTROSCOPICALLY IDENTIFIED WHITE DWARF STARS
E.M. Sion, Villanova University, School of Liberal Arts & Sciences, Dept. of Astronomy, *Villanova, Pennsylvania* 19085 (AST78-13396)

This grant will provide funds for updating a catalogue of spectroscopically identified white dwarf stars. The number of such stars has doubled since the first catalogue was published. In addition to including much new material in the catalogue, there will be new user additions and corrections. The updated catalogue will contain data needed for many statistical studies of these objects. It will be valuable for studies of the kinetics, space densities, and origins of various types of white dwarf stars. The catalogue will enable astronomers to separate and classify various types of compact stars. Other applications of this catalogue include studies of the internal structure of white dwarf stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0027, GROUND-BASED ULTRAVIOLET PHOTOMETRY OF BINARIES
Unknown, Vanderbilt University, Graduate School, *21st Ave. S., Nashville, Tennessee* 37203 (NSG 7543)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0028, APPLICATION OF HILL'S CURVES TO THE STUDY OF CLASSICAL TRIPLE STELLAR SYSTEMS
V. Szebehely, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engin & Engin Mech, *200 W. 21st, Austin, Texas* 78712 (AST76-19654 A01)

Hill's method of curves of zero velocity discussed in his lunar theory will be extended to the study of the dynamical properties of classical triple stellar systems. His method used in his lunar theory will be generalized to three stellar masses that revolve around each other in the classical configuration: two forming a binary and the third revolving around this double star. Conditions of stability for such astronomically important systems are to be established analytically for any stellar masses, any eccentricities and any semi-major axes. These values will be compared to the observational data of actual stellar systems and the stability of known triple systems investigated. A comparison will also be made with Harrington's results obtained by numerical integration and his results extended to cases not included in his studies. The conditions for stability of arbitrarily high levels of hierarchical systems will be evaluated and applied to Evan's hierarchical system of multiple stars.

Prior support was by NSF grant AST 76-19654.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0029, ULTRAVIOLET SPECTROSCOPY OF GIANT AND SUPERGIANT STARS
S.B. Parsons, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NSG 5328)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0030, INTERMEDIATE AGE CLUSTERS OF THE MAGELLANIC CLOUDS
P.W. Hodge, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle*, *Washington* 98105 (AST76-17598 A01)

The Magellanic Clouds in the Southern Hemisphere present a unique opportunity to study stellar evolutionary patterns for stars of moderate and low heavy element abundance. An observational program of determining color-magnitude (C-M) diagrams for populous intermediate-age clusters and the subsequent detailed comparison of them with theoretical models will be carried out. This research is a continuation of observations and analysis that led to the production of C-M diagrams for NGC 2164 and several clusters near it in the Large Megellanic Cloud (LMC), with the surprising result that these clusters showed evidence of different heavy element abundances even though their ages are nearly the same. A check on this result using superior observational material (Cerro Tololo Interamerican Observatory (CTIO) 4-meter plates already taken) will be done. The determination of C-M diagrams for additional LMC clusters and some SMC clusters will also be carried out.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0031, SEARCH AND ANALYSIS OF THE X-RAY EMISSION FROM LUMINOUS TYPE STARS
J.P. Cassinelli, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Astronomy, *500 Lincoln Dr.*, *Madison*, *Wisconsin* 53706 (NAS 8-33340)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

GENERAL

11.0001, JOINT USE OF RESOURCES FOR OPERATION OF THE NASA AMES UNIVERSITY CONSORTIUM
L. Eisenberg, California State University & Colleges, San Francisco State University, Graduate School, *1600 Holloway Ave.*, *San Francisco*, *California* 94132 (NCA 2-660901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

11.0002, OPERATION OF NASA INDUSTRIAL APPLICATION CENTER
Unknown, University of Southern California, Graduate School, *3551 University Ave.*, *Los Angeles*, *California* 90007 (NASW 3235)

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For information on obtaining these films, contact:
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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N79-21994* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 104
Jan. 1979 152 p
(NASA-SP-7037(104)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 532 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in December 1978. Author

N79-21995* National Aeronautics and Space Administration, Washington, D. C.
A CUMULATIVE INDEX TO AERONAUTICAL ENGINEERING, A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 105
Jan. 1979 685 p
(NASA-SP-7037(105)) Avail: NTIS HC E05 CSCL 01A

This bibliography is a cumulative index to the abstracts contained in NASA SP-7037 (93) through NASA SP-7037 (104) of Aeronautical Engineering: A Continuing Bibliography. NASA SP-7037 and its supplements were compiled through the cooperative efforts of the American Institute of Aeronautics and Astronautics (AIAA) and the National Aeronautics and Space Administration (NASA). This cumulative index includes subject, personal author, corporate source, contract, and report number indexes. Author

N79-21996# Advisory Group for Aerospace Research and Development, Paris (France).
HIGH ANGLE OF ATTACK AERODYNAMICS
Jan. 1979 542 p refs In ENGLISH and FRENCH Conf. held at Sandefjord, Norway, 4-6 Oct. 1978
(AGARD-CP-247; ISBN-92-835-0230-2) Avail: NTIS HC A23/MF A01

Reports were presented on: (1) studies of configurations of practical application (10 papers); (2) mathematical modelling and supporting investigations (12 papers); (3) design methods (7 papers), and (4) air intakes (2 papers). Eight additional short presentations on these subjects are also documented. For individual titles, see N79-21997 through N79-22034.

N79-21997# National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Lab.
EFFECT OF HIGH ANGLES OF ATTACK ON DYNAMIC STABILITY PARAMETERS c02
K. J. Orlik-Rueckemann *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 14 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

Effects of flight at high angles of attack are presented for dynamic stability parameters and their significance for the analysis of aircraft motion at those flight conditions. The topics included: (1) the strong nonlinear variations of many stability parameters with angle of attack, (2) the emergence of new categories of parameters such as cross-coupling derivatives that are only of interest for high angle-of-attack or other asymmetrical flight conditions, (3) the significance of time-dependent parameters, such as represented by derivatives due to time rates of change of angles of attack and sideslip, (4) the strong configuration dependence of aerodynamic characteristics, as illustrated by large effects of strakes and of various shapes of aircraft forebody, and (5) the need for establishing and verifying a mathematical model that would satisfactorily describe the motion of an aircraft in the presence of all these high angle-of-attack effects. J.A.M.

N79-21998# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
HIGH ANGLE OF ATTACK CHARACTERISTICS OF DIFFERENT FIGHTER CONFIGURATIONS c05
H. John and W. Kraus *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 15 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

Increased maneuverability at the lower end of the flight envelope offers new and attractive possibilities for fighter aircraft. To extend the flight regime at low speeds up to high angles of attack beyond maximum lift requires the ability to trim and control the aircraft and by this avoid departure and spin susceptibility at those conditions. Basic aerodynamic characteristics of different fighter configurations at separated flow beyond maximum lift are reviewed where the resultant derivatives are completely different from those associated with attached flow. The change in trim conditions is primarily dependant on wing planform and overall aircraft configuration. Results are shown about the aerodynamic development of aircraft configuration which meet these requirements and, at the same time, minimize the resulting drag penalties in the conventional angle of attack regime. J.A.M.

N79-21999# Royal Aircraft Establishment, Farnborough (England).
SOME UK RESEARCH STUDIES OF THE USE OF WING-BODY STRAKES ON COMBAT AIRCRAFT CONFIGURATIONS AT HIGH ANGLES OF ATTACK c05
G. F. Moss *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 19 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

Experimental research of interest to design engineers incorporating strakes in combat-aircraft configurations is considered. It is likely to be many years before a satisfactory mathematical model is achieved for the detailed flow about such configurations, and there is thus an urgent need to explore the various aerodynamic features of these devices experimentally both to obtain satisfactory solutions to current problems and to guide theoretical work which will form the basis of future design methods. Author

N79-22000*# General Dynamics/Fort Worth, Tex.
DESIGN GUIDELINES FOR THE APPLICATION OF FOREBODY AND NOSE STRAKES TO A FIGHTER AIRCRAFT BASED ON F-16 WIND TUNNEL TESTING EXPERIMENT c05
C. W. Smith and C. A. Anderson *In* AGARD High Angle of

Attack Aerodyn. Jan. 1979 11 p refs (For primary document see N79-21996 13-01)
(Contract NAS1-15006)
Avail: NTIS HC A23/MF A01 CSCL 01C

During the YF-16 and F-16 developmental wind tunnel test program, numerous variations in nose and forebody strakes were investigated. These data were reviewed, and the strake aerodynamic characteristics coalesced into design guidelines for the application of strakes to fighter aircraft. The design guides take the form of general equations governing the modification of forebody strakes to obtain a linear pitching moment curve and the calculation of the resulting lift and drag increments. Additionally, qualitative comments are made concerning the effects of strake geometry on lateral/directional stability. It is concluded that the generation of incremental strake lift is primarily dependent upon the area affected by the strake-induced vortex and that strake planform is of secondary importance. Forebody strakes have small beneficial effects on lateral/directional stability if properly designed; however, significant gains are easily attained with nose strakes. J.A.M.

N79-22001# Northrop Corp., Hawthorne, Calif. Aerodynamics Research Dept.
FOREBODY/WING VORTEX INTERACTIONS AND THEIR INFLUENCE ON DEPARTURE AND SPIN RESISTANCE c02
A. M. Skow, A. Titiriga, Jr., and W. A. Moore *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 26 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

In-depth studies were conducted to determine the effects of these shed vortices and to isolate parameters which strongly influence them. Arising from these studies, methodologies were developed which can be used as general guidelines in the design of both aircraft forebody shapes and hybrid-wing planform shapes such that the interactions between these vortex systems will enhance aircraft stability. J.A.M.

N79-22002# Royal Aircraft Establishment, Farnborough (England).
STRAKE-INDUCED SEPARATION FROM THE LEADING EDGES OF WINGS OF MODERATE SWEEP c02
S. P. Fiddes and J. H. B. Smith *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 12 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

Mechanisms were proposed to account for the observation that, on a wing of moderate sweep and aspect ratio, leading edge separation occured at a lower incidence when strakes (i.e. highly swept, forward extensions to the wing root) were attached ahead of it. The effect on the main wing of the vortices resulting from the leading edge separation on the strake was considered, and a simplified approach to modelling the flow over strake-wing combinations was introduced. J.A.M.

N79-22003# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
AERODYNAMIC CHARACTERISTICS OF A FIGHTER-TYPE CONFIGURATION DURING AND BEYOND STALL c02
W. Staudacher, B. Laschka, P. Poisson-Quinton (ONERA, Paris, France), and J. P. Ledy (ONERA, Paris, France) *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 15 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

Low speed wind tunnel tests were conducted with a MBB pilot model. Angle of attack regime investigated comprised alpha = 0 divided by 90 deg. Emphasis was directed towards the stability and/or control contributions of configurational items such as strakes, canards, tails, rudders and controls and maneuver flap systems as well as the technique of concentrated, spanwise blowing. Isolated and combined effects of those devices and systems are demonstrated, and some unconventional control devices are introduced. J.A.M.

N79-22004# Lockheed-Georgia Co., Marietta. Flight Sciences Div.
THE APPLICATION OF SPANWISE BLOWING FOR HIGH ANGLE OF ATTACK SPIN RECOVERY c05
J. J. Cornish, III and M. W. M. Jenkins *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 12 p (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

A unique autorotation tunnel test was performed on a 1/30th scaled model of an F-4 fighter configuration. During this test, air was blown spanwise over the wing from various nozzle locations and the influence of this blowing on the spinning mode was recorded. Over 50 test conditions were evaluated for both flat (alpha = 45 degrees) and steep (alpha = 80 degrees) spin modes. The wing blowing was very effective in arresting the spin for the steep spin mode and not very effective in stopping the flat spin. Nose blowing was also evaluated with only marginal success. An optimum wing nozzle location and blowing level was identified. These data, when scaled to full-scale values showed that the required nozzle diameter was 1.92 inches, located close to the wing root 1/4 chord point and 18 lb/sec. of air was required to affect recovery. More efficient and effective recovery is possible in the tunnel with an additional degree of freedom and with empennage blowing. Further, larger scale testing is urged. G.Y.

N79-22005# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
BEHAVIOR OF A TRANSPORT AIRCRAFT WITH A HIGH ASPECT RATIO WING AT A HIGH ANGLE OF INCIDENCE [COMPORTEMENT A HAUTE INCIDENCE U'UN AVION DE TRANSPORT A AILE A GRAND ELANCEMENT] c05
D. Collard *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 12 p In FRENCH (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

Results of wind tunnel test on a model of a Concorde supersonic transport aircraft with a high aspect ration wing at a high angle of incidence are reported. Graphs, and especially flow visualization charts of the air flow over the top of the airfoil, are presented. Transl. by G.Y.

N79-22006*# Rockwell International Corp., Downey, Calif. Space Systems Group.
AERODYNAMIC DESIGN OF THE SPACE SHUTTLE ORBITER c16
W. E. Bornemann and T. E. Surber *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 24 p refs (For primary document see N79-21996 13-01)
(Contract NAS9-14000)
Avail: NTIS HC A23/MF A01 CSCL 22B

An overview of the wind tunnel program is given and aerodynamic characteristics of the final configuration are described. Aerodynamic parameters critical to definition of Orbiter entry control and performance are identified. Trim capability and stability and control characteristics are discussed at critical regions in the entry trajectory. Methods are described to define reaction control rocket effectiveness and aerodynamic interactions during the initial portion of entry. At hypersonic speeds, wind tunnel results of viscous interaction effects at high angles of attack are discussed. In the supersonic region, critical stability and control parameters and wind tunnel results are described. At subsonic speeds, comparisons are shown between predicted aerodynamic characteristics and data from the approach and landing flight test program. G.Y.

N79-22007# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VORTEX PATTERN DEVELOPING ON THE UPPER SURFACE OF A SWEPT WING AT HIGH ANGLE OF ATTACK c02
Jean Mirande, Volker Schmitt, and Henri Werle *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 18 p refs In FRENCH; ENGLISH summary (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

An experimental study, based on a swept wing, was undertaken in a water tunnel and a wind tunnel at low speeds (V sub o less than or equal to 90 m/s). The vortex flow effects on this wing are illustrated from global effort measurements and static pressure distributions. The domain of vortex appearance was deduced as a function of both sweep angle and angle of attack. An attempt is made to describe the physical pattern of

the vortex flow, from its formation near the apex to its breakdown at the trailing edge. By means of a directional probe, the flow over the wing was determined. G.Y.

N79-22008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

STABLE AND UNSTABLE VORTEX SEPARATION c02

Erich H. Wedemeyer *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

A theoretical study of the stability of leading edge separation on delta wings is presented. The theory explains the change from steady vortex type separation to flow with unsteady separation bubble. Calculations show that solutions of the vortex-sheet model of leading edge separation can become unstable if the angle of attack is sufficiently high. The critical angle of attack decreases with decreasing sweepback angle. The calculated stability boundary is in good agreement with the boundary for observed leading edge vortices. The findings suggest that the change from vortex type to bubble type separation is due to the change from stable to unstable leading edge vortices. The theory explains the effect of a strake on a wing of moderate sweep and aspect ratio: the strong leading edge vortices generated by the strake induce an outboard flow on the main wing and thereby increase the effective sweep of the leading edge. The higher effective sweep stabilizes the leading edge separation on the main wing. G.Y.

N79-22009# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

UNSTEADY CALCULATION OF VORTEX SHEETS EMITTED BY HIGHLY LOADED LIFTING SURFACES c02

Colmar Rehback *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 9 p refs In FRENCH; ENGLISH summary (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

The vortex sheets that form at the trailing edge and tips and, for higher angles of attack, from the leading edge of lifting surfaces, tend towards well organized and stable shapes only for specific configurations (e.g. high sweep angles) and within a well-defined range of angles of attack. The method used is intended for three-dimensional incompressible flows. It is based on an application of the Lagrangian variables to the integro-differential system made of the Green identity and the Helmholtz equation, discretized in the form of point vortex singularities. During this numerical study of the influence of the obstacle geometry and incidence on the time evolution and stability of the vortex sheet, the sudden setting in motion of two simple configurations is dealt with: a plane rectangular wing and a plane delta wing, both of unity aspect ratio. Two problems are especially dealt with: that of the vortex core formation and that of the gradual appearance, highly influenced by geometry and angle of attack, of the sheet instabilities. G.Y.

N79-22010# Technische Universitaet, Brunswick (West Germany). Inst. fuer Stroemungsmechanik.

ON THE VORTEX FORMATION OVER A SLENDER WING AT LARGE ANGLES OF INCIDENCE c02

Dietrich Humnel *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 17 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

An experimental study of the flow field around an A = 1 delta wing at an angle of attack of alpha - 20.5 degrees is presented. The effect of Reynolds number on the formation of the secondary vortex is studied in detail. Boundary layer measurements were carried out for laminar and turbulent boundary layers and the bound vortex lines in the lifting surface were determined for both cases. The flow field was measured in four planes perpendicular to the free stream direction and located in different positions downstream of the wing trailing edge. The magnitude and the direction of the local velocity vector were determined by means of a 5-hole probe. The results are given for each plane by lines of constant total pressure, static pressure, dynamic pressure and by a presentation of the local flow directions. The interference between leading-edge vortex, secondary vortex and trailing edge-vortex is studied in detail. G.Y.

N79-22011*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SYMMETRICAL AND ASYMMETRICAL SEPARATIONS ABOUT A YAWED CONE c02

David J. Peake, F. Kevin Owen (Owen Intern., Inc., Palo Alto, Calif.), and Hiroshi Higuchi (Dyn. Technol., Inc., Torrance, Calif.) *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 27 p refs (For primary document see N79-21996 13-01) (Contract NAS2-9663)

Avail: NTIS HC A23/MF A01 CSCL 01A

Three-dimensional flow separations about a 5 degree (semiapex angle, theta sub C), 1.4 m long, circular cone up to moderately high relative incidence, alpha/theta sub C approximately 5, were studied in the Mach number range 0.3 < M sub infinity < 1.8. The cone was tested in the Ames 1.8 by 1.8 m wind tunnel at Reynolds numbers, R sub L infinity, based on the cone length, L, from 4.5 times 10 to the 6th power to 13.5 times 10 to the 6th power, under nominally zero heat transfer conditions. Overall forces and mean surface pressures were compared with earlier measurements. Supportive three-dimensional laser velocimeter measurements of mean and fluctuating velocity in a slightly asymmetric vortex wake about a slender tangent ogive cylinder at incidence having respective nose and overall body fineness ratios of 3.5 and 12, are included. G.Y.

N79-22012# Bristol Univ. (England). Dept. of Aeronautical Engineering.

PRESSURES ON A SLENDER BODY AT HIGH ANGLE OF ATTACK IN A VERY LOW TURBULENCE LEVEL AIR STREAM c02

B. L. Hunt and P. C. Dexter *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 14 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

Experimentally measured transient pressures at low speeds on a model consisting of a circular cylinder with a tangent ogive nose in the angle of attack range from 30 deg to 90 deg are reported. Great care was taken to eliminate extraneous disturbances: a wind tunnel with an extremely low level of free stream turbulence (approx. 0.01%) was used, the model was rigidly mounted and efforts were made to ensure laminar separation without turbulent re-attachment. By comparing the result with those obtained previously on the same model in similar tests at a higher level of free stream turbulence (approx. 0.7%) it is shown that there is a dramatic reduction in unsteadiness in the low turbulence level air stream and switching of the flow pattern is virtually eliminated. It is found that the mean unswitched level is dependent on the roll angle of the model, and hence, that strict control of the free stream conditions is not sufficient to guarantee results which are independent of the experimental equipment. The inherent unsteadiness present in the flow pattern is presented. S.E.S.

N79-22013# British Aerospace Dynamics Group, Bristol (England). Aerodynamics Research Group.

WIND AND WATER TUNNEL INVESTIGATIONS OF THE INTERACTION OF BODY VORTICES AND THE WING PANELS OF A MISSILE CONFIGURATION c02

J. R. Deane *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 18 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

The interaction with wing panels of vortices formed by flow separation on the leeside of the forebody of an inclined, cruciform wing-body combination was studied. A low-speed flow visualization experiment was conducted using the dye line technique in a water tunnel, where the generation of the symmetric body vortex pair in the incidence angle range was 15 deg to 35 deg. The phenomenon of breakdown of the ordered vortex structure was observed when the vortices pass in the vicinity of wing panels mounted downstream on the body. A supersonic wind tunnel test in which pressure plotting on a wing panel of a geometrically similar wing-body combination was performed. Incidence angles in the range 15 deg to 25 deg were considered at a Mach number of 2 with the pressure tapped wing panel

rolled into the leeside flow field. Integration of the pressure distributions yielded information on panel loads which was compared with estimates available from semi-empirical prediction methods. It is shown that prediction accuracy is low for the loads on panels when they are rolled into the vicinity of the vortices. S.E.S.

N79-22014# S. A. Engins Matra, Velizy (France).
AERODYNAMIC CHARACTERISTICS OF BODIES OF REVOLUTION EQUIPPED WITH WINGS OF VARIOUS ASPECT RATIOS [CHARACTERISTIQUES AERODYNAMICS DES CORPS DE REVOLUTION MUNIS D'AILES D'ALLONGEMENTS DIVERS] c02
L. Mifsud *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 24 p refs In FRENCH; ENGLISH summary (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

Water tank and wind tunnel tests were made on bodies of revolution and finned bodies of small wing aspect ratio. Results of lift and side force, pitching and yawing moments, and wall pressure distributions are presented for angles of attack between 0 and 45 or 70 deg. The parameters are the Mach number, the wing length, and the wing span. Results show the effects of the wing parameters on high incidence phenomena and especially on lateral forces and moments. Author

N79-22015# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMIC CHARACTERISTICS OF A MISSILE FEATURING WING WITH STRAKES AT HIGH ANGLES OF ATTACK c02
M. Akcay, B. E. Richards (DFVLR, Goettingen, West Ger.), W. Stahl, and A. Zarghami *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 7 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

The forces and pressure distribution on a typical missile configuration with low aspect ratio trapezoidal wings fitted both with and without triangular strakes at angles of incidence up to 32 deg were studied. Normal force and pitching moment measurements showed that different strakes extending forward from the inboard region of the trapezoidal wings straightened the normal force curve and increased the normal force coefficient considerably and improved the pitching moment variation at incidences above 12 deg. Measurements of pressure over the suction side of the body, wings and one of the configuration of strakes and application of various flow visualization techniques at transonic speeds and water tunnel tests provided some insight into the mechanisms that cause the improvements in force characteristics. The vortices generated by the strakes are shown to interact favourably not only with the flow over the wing, to suppress the unfavorable effects of large separation, but also with the flow over the body. The distribution of the increment in normal force on the various parts of the configuration caused by the strakes was analyzed. S.E.S.

N79-22016# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
ON THE LEE-SIDE FLOW OVER DELTA WINGS AT HIGH ANGLE OF ATTACK c02
Joachim Szodruch and Uwe Ganzer *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 7 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

A classification of various types of lee-side flow for slender delta wings is presented for a range of supersonic Mach number and angle of attack. Two particular types of flow which occur at high angle of attack are discussed. One type exists when the leading edges are subsonic. A shock wave between the strong conterrotating leading-edge-vortices was determined. The other type of flow occurs for supersonic leading edges in which case a pair of separation bubbles occurs with embedded shock waves on top. Strong non-conical effects were observed. S.E.S.

N79-22017# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
MEASUREMENTS OF THE SUPERSONIC FLOW FIELD PAST A SLENDER CONE AT HIGH ANGLES OF ATTACK c02
W. J. Bannink and C. Nebbeling *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 15 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

The flow field past a 7.5 deg semi-apex angle circular cone at angles of attack was investigated experimentally at a free stream Mach number of 2.94. In a cross-sectional plane the conical flow direction, the conical Mach number and the static pressures were determined, using a conical-head directional probe. Surface pressure distributions and oil flow patterns revealed flow separation at an angle of attack of about the cone half-angle. The separation is coupled with the formation of a vortex system. At values of alpha exceeding 14 deg a double separation type of flow was observed: a primary and a secondary vortex at either side of the leeward symmetry plane. Conical supersonic flows were detected, adjacent to the cone surface. Shock waves were measured inside the conical supersonic region, also the occurrence was verified of a shock wave close to the cone surface and extending slightly across the leeward symmetry plane. At 22 deg, the existence was confirmed of a separated vortical singularity in the leeward symmetry plane. S.E.S.

N79-22018*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL SIMULATION OF SUPERSONIC CONE FLOW AT HIGH ANGLE OF ATTACK c02
David S. McRae and M. Y. Hussaini (NASA Langley Res. Center) *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)
(Contracts NAS1-1410; NAS1-14472)
Avail: NTIS HC A23/MF A01 CSCL 01A

A conical symmetry assumption is applied to the full Navier-Stokes equations resulting in an equation set containing time and two coordinate directions as independent variables. The set is integrated by use of a finite difference technique for the particular case of sharp cones at incidence. Solutions are obtained and compared with experiment for auxiliary conditions corresponding to both laminar and turbulent flows. Closure for the turbulent flow case is provided by use of a scalor eddy viscosity model based on the mixing length hypothesis. Modifications to the eddy viscosity model were found which led to excellent surface pressure and surface flow direction agreement for turbulent flow at low supersonic Mach numbers. It is apparent that further work on the turbulence model is necessary for agreement at higher supersonic Mach numbers. S.E.S.

N79-22019*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RECENT THEORETICAL DEVELOPMENTS AND EXPERIMENTAL STUDIES PERTINENT TO VORTEX FLOW AERODYNAMICS, WITH A VIEW TOWARDS DESIGN c02
John E. Lamar and James M. Luckring *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 31 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

Recent progress in a research program directed toward an improved vortex flow technology base was reviewed. Analysis methods for conical flow and analysis and design methods for nonconical flows are presented. Applications are made for a variety of planar, nonplanar, and interferring lifting surfaces. Several methods are shown to provide reasonable estimates of over-all forces and moments for simple wing planforms with the suction analogy method currently offering the most versatility for arbitrary configuration applications. For the prediction of surface loadings the free vortex sheet method being developed by Boeing is shown to have considerable promise and further development of this type of method is encouraged. A data base for ogee strake-wing configurations is summarized with an emphasis on the requirements for maximizing the interference lift. A strake planform design procedure is discussed and a first solution (gothic in planview) is integrated with a wing body. The data show the strake to exhibit expected stable vortex characteristics. It was found that, apart from increasing sweep, conically cambered delta wings developed drag levels approaching that of attached flow with increasing either the lift or the wing camber height, lastly, an approximate vortex flow design method, based on the suction analogy, is outlined and an example is given. S.E.S.

N79-22020# National Aerospace Lab., Amsterdam (Netherlands).
A COMPUTATIONAL MODEL FOR THE CALCULATION OF THE FLOW ABOUT WINGS WITH LEADING-EDGE VORTICES **c02**
H. W. M. Hoeijmakers and B. Bennekers *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 11 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

The mathematical model replaced the spiralling free shear layer springing from the leading edge by a free vortex sheet which is terminated by a combination of a feeding sheet plus a discrete line vortex/sink. The strength of the sink is related to the entrainment of the rotational core and derived here from semi-empirical arguments. The resulting potential flow problem is solved employing a higher-order panel method which involves some recently developed ideas for obtaining a numerically efficient method with second-order accuracy. The method is applied to the calculation of the flow about a delta wing at incidence. S.E.S.

N79-22021# Boeing Aerospace Co., Seattle, Wash.
SUBCRITICAL DRAG MINIMIZATION FOR HIGHLY SWEPT WINGS WITH LEADING EDGE VORTICES **c02**
E. N. Tinoco and H. Yoshihara *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 9 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

The subsonic lift to drag ratio of supercruiser type wings was studied at sufficiently large lifts for which flow separation cannot be avoided. In the presence of the resulting leading-edge vortex, minimum drag due to lift is no longer dictated by spanwise load distribution alone but is also a function of the chordwise loading. For the resulting nonlinear problem a higher order panel method utilizing a vortex sheet model is used to search for an optimal design. A brief outline of the computational method is given fllowed by examples validating the procedures. Results of the search for an 'optimal camber' are discussed. M.M.M.

N79-22022# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
NORMAL FORCE AND PITCHING MOMENT OF WING-BODY COMBINATIONS IN THE NONLINEAR ANGLE-OF-ATTACK RANGE AT SUBSONIC SPEEDS **c05**
C. P. Schneider and D. Nikolitsch *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

Two procedures on the nonlinear lifting surface theory are presented. One method for the determination of the factor K sub B(W) represents the effect of the wing on the body-forces and moments due to lift carry-over, and predicts the normal force interference factors. The other method determines K sub B(W). It uses the nonlinear lifting surface theory for the calculation of normal force and moment of a slowly pitching wing alone, and to get the same quantities for a substitute wing which represents the original wing plus a rectangular flat middle section in place of the body between the wing root chords. The results of the two procedures call for an improved prediction method, as comparable quasi-steady data from experiments, which may serve to confirm the results of one or the other method are not available at present. Free vortex tracing of discrete vortices by conventional two-dimensional theory is proposed. Viscous vortices with core are assumed. M.M.M.

N79-22023*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTION OF AERODYNAMIC CHARACTERISTICS FOR SLENDER BODIES ALONE AND WITH LIFTING SURFACES TO HIGH ANGLES OF ATTACK **c02**
Leland H. Jorgensen *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 40 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

A method is presented for computing normal force and pitching moment coefficients for slender bodies of circular and noncircular cross section alone and with lifting surfaces. A semiempirical term representing viscous-separation crossflow is added to a term representing potential-theory crossflow. For bodies of revolution, computed aerodynamic characteristics agree with measured results for investigated free-stream Mach numbers from 0.6 to 2.9 and for angles of attack from 0 deg to 180 deg. For bodies of elliptic cross section, measured results are predicted well over the investigated Mach number range from 0.6 to 2.0 and the angle range from 0 deg to 60 deg. For all bodies the predictions are best at supersonic Mach numbers. For body-wing and body-wing-tail configurations, measured normal force coefficients and centers are predicted at the upper test Mach number of 2.0. As the Mach number is decreased to 0.6, the agreement for the normal-force coefficients rapidly deteriorates. When model flow-separation and vortex patterns are asymmetric, undesirable side forces are usually measured on the models at subsonic Mach numbers and zero sideslip angle. Generally, the side-force coefficients decrease or vanish with: increase in Mach number, decrease in nose fineness ratio, nose blunting, and flattening of body cross section. M.M.M.

N79-22024# Nielsen Engineering and Research, Inc., Mountain View, Calif.
PREDICTION OF LATERAL AERODYNAMIC LOADS ON AIRCRAFT AT HIGH ANGLES OF ATTACK **c02**
S. B. Spangler, S. C. Perkins, Jr., and M. R. Mendenhall *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 14 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

The lateral loads on high speed fighter-bomber configurations at high angles of attack and small angles of sideslip were studied. The configurations of interest are characterized by slender pointed noses that generate asymmetric separation vortices at angles of attack in the 25 to 45 degree range. The methods consist of a nose vortex shedding flow model, a vortex lattice wing/body/strake flow model, and a tail interference model. All are potential flow methods and were applied at incompressible speeds. The methods account for noncircular nose cross sections, prediction of separation location on the nose and interaction between nose and strake vortices. Calculations were made to compare the predicted results with measurements of vorticity distribution, velocities in the separated region, and forces on noncircular noses and forces and moments on complete aircraft configurations. The predicted results agree with the data, show the proper trends, and demonstrate the proper physical characteristics of the flow. M.M.M.

N79-22025# Systems Research Labs., Inc., Newport News, Va.
PREDICTION AND MEASUREMENT OF THE AERODYNAMIC FORCES AND PRESSURE DISTRIBUTIONS OF WING-TAIL CONFIGURATIONS AT VERY HIGH ANGLES OF ATTACK **c02**
Richard P. White, Jr. *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 16 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

The three-dimensional viscous lifting surface theory that developed to predict the distribution of aerodynamic loading on arbitrary planforms having attached vortex flows at high angles of attack is discussed. Comparisons between measured and predicted performance and pressure distribution data for a wing-strake configuration at a high angle of attack are reported. Limitations of the prediction technique as well as the potential of utilizing vortex lift to amplify the performance characteristics of highly maneuverable aircraft is outlined. M.M.M.

N79-22026*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH ANGLE OF INCIDENCE IMPLICATIONS UPON AIR INTAKE DESIGN AND LOCATION FOR SUPERSONIC CRUISE AIRCRAFT AND HIGHLY MANEUVERABLE TRANSONIC AIRCRAFT **c05**
Leroy L. Presley *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

The effects of angle of attack on supersonic mixed compression inlet performance at four different locations about a hypothetical forebody are given. A computational method to predict optimum inlet location, orientation, and centerbody control

schedule for design and off-design performance is described. The effects of inlet location and a forward canard on the angle-of-attack performance of a normal shock inlet at transonic speeds were studied. Proper integration of inlet location and a forward canard can enhance the angle-of-attack performance of a normal shock inlet. Two lower lip treatments for improving the angle-of-attack performance of rectangular inlets at transonic speeds are discussed. M.M.M.

N79-22027# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Military Airplane Div.

INTAKE DESIGN AND INTAKE/AIRFRAME INTEGRATION FOR A POST-STALL FIGHTER AIRCRAFT CONCEPT c05

K. W. Lotter and J. Malefakis *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 16 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

Results from subsonic scale model tests carried out for intake geometries especially designed for high angle of attack capability are discussed. A unit-composed intake model representing a twin-engine fighter aircraft was tested with two basic intake positions in a shielded location, one under the fuselage and one under the wing strakes on both sides of the fuselage. Two different axial positions were tested. An external compression, horizontal ramp inlet design was chosen for the tests. Different auxiliary intakes, all fitted to the lower side of the intake were tested. Various rotatable forward cowl lip designs and a cowl slot were included in the investigations. A shielded intake location offers a high potential for improvement in inlet maneuver capability. Sufficient shielding is generally given for the under-fuselage position. For the side-intakes located under the strakes a position as far downstream as possible is desirable. For such shielded intakes only small performance losses occurred at incidences up to 35 deg. Variable cowl lip geometry introduced for subsonic maneuver improvement offers an attractive means for optimum intake/engine mass flow matching at supersonic speeds by varying the intake capture area. M.M.M.

N79-22028# Texas Univ. at Austin. Dept. of Mechanical Engineering.

COMPRESSIBILITY EFFECTS ON THE SYMMETRIC BODY VORTEX WAKE OF AN OGIVE NOSE CYLINDER c02

William L. Oberkampf and Timothy J. Bartel *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 4 p refs (For primary document see N79-21996 13-01)

(Contract F08635-77-C-0049)

Avail: NTIS HC A23/MF A01

An extensive experimental investigation of the symmetric body vortex wake was conducted. Cone probe measurements were made on the leeside of an ogive nose circular cylinder for three different supersonic freestream conditions. Measurements of total pressure, Mach number, and three orthogonal velocity components were made at four angles of attack of the body at various axial stations. These data were processed to infer the position of the primary body vortex in the cross flow plane, local circulation distribution in the cross flow plane, vortex core size, and total circulation in the cross flow plane. Although limited results are discussed, particular emphasis is placed on the effects of transonic cross flow Mach numbers on the structure of the body vortex wake. J.A.M.

N79-22029# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Aeronautics.

WIND TUNNEL TEST AT LOW SPEEDS OF A DORSAL AIR INTAKE ON A FIGHTER CONFIGURATION c02

Sven-Olof Ridder *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 3 p (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

A wind tunnel model with a swept wing and a dorsal air intake mounted well aft on the fuselage was investigated in a low speed wind tunnel with respect to the flow quality of the air intake flow. It was found that the air intake flow was satisfactory at zero angle of yaw for angles of attack up to 20 degrees. Even a moderate angle of yaw, however, resulted in a rather high level of intake flow distortion as caused by the ingestion of forebody vortices. A large number of forebody mounted flow control devices were tested and among these only a canopy mounted device was found effective in reducing the intake flow distortion to an acceptable level. J.A.M.

N79-22030# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

VISUALISATIONS AND CALCULATIONS OF AIR INTAKES AT HIGH ANGLES OF ATTACK AND LOW REYNOLDS NUMBER c02

P. C. Perrier and J. Periaux *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 2 p refs In FRENCH (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

The operation of compressors can be strongly perturbed at a high angle of incidence by the instability of the flow created by separation at the edges of the air intake. Both flow visualization and the direct solution numerical solution of the Navier-Stokes equation are complementary methods of analyzing the phenomena. To visualize what is intervening at the interior of the air intake, the flow can be studied at very low velocity and at a low Reynolds number by the injection of colored fluid in a two dimensional flow in a hydrodynamic test tunnel so that an ultra ultra-rapid film of the transonic stream lines can be obtained. The instability of the separation of at the air intake can be calculated only by the exact or approximate solution of the Navier-Stokes equation. Results obtained by using a least squares finite element method for the direct solution of the Navier-Stokes instability equation are presented. This method resolves the nonlinearity of the equation by iteration of the Stokes equation which is itself resolved in an original manner. Transl. by A.R.H.

N79-22031# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.

STATE OF ART OF NONLINEAR, DISCRETE-VORTEX METHODS FOR STEADY AND UNSTEADY HIGH ANGLE OF ATTACK AERODYNAMICS c02

Osama A. Kandil *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 5 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

In all the existing inviscid models, the lines of primary separation were assumed to be known a priori and, hence, these models can only treat wings with sharp edges. In this model, the continuous vortex sheets (bound and free) were approximated by a distribution of concentrated vortex lines. The bound sheet is modelled by a bound-vortex lattice, and the free sheet is modelled by segmented free-vortex lines (steady-flow problem) or a growing free-vortex lattice (understeady-flow problem). With this three-dimensional model, the boundary conditions were satisfied at certain control points on the bound and free vortex system, the shape of the free-vortex lines was obtained, and the pressure distribution was calculated on the wing surface. J.A.M.

N79-22032# Bristol Univ. (England). Dept. of Aeronautical Engineering.

ON SLENDER WINGS WITH LEADING EDGE CAMBER c02

R. K. Nangia *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

The presence of leading edge camber on wing or wing body configuration of low aspect ratio is known to improve their aerodynamic efficiency. A research program to develop design methods on this subject is reviewed. J.A.M.

N79-22033# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

AN EXPERIMENTAL INVESTIGATION OF THE ENTRAINMENT OF A LEADING-EDGE VORTEX c02

N. G. Verhaagen and L. vanderSnoek *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 5 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

An experimental investigation of the flow field of a leading edge vortex, produced by a sharp edged unit aspect ratio delta wing at an angle of attack of 20 deg, was carried out at 45 m/sec. Velocity and total pressure distributions were obtained by using a fixed-attitude five-hole probe. On the basis of the experimental

results, a number of control volumes of different cross sectional dimensions enclosing the rotational vortex core were chosen. For each of the control volumes the entrainment was estimated. J.A.M.

N79-22034# Aeritalia S.p.A., Torino (Italy). Combat Aircraft Div.

A SURVEY OF RECENT HIGH ANGLE OF ATTACK; WIND TUNNEL TESTING AT AERITALIA **c02**

G. Bucciantini, R. DeSilvestro, and L. Fornaster *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 4 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

The present status of investigation on wind tunnel testing techniques at high angles of attack and on stall/post stall characteristics of configurations typical of modern combat aircraft is illustrated. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-22035*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LOW-SPEED WIND-TUNNEL INVESTIGATION OF A LARGE-SCALE VTOL LIFT-FAN TRANSPORT MODEL

Kiyoshi Aoyagi Apr. 1979 72 p refs

(NASA-TM-78560; A-7734) Avail: NTIS HC A04/MF A01 CSCL 01A

An investigation was conducted in the NASA-Ames 40 by 80 Foot Wind Tunnel to determine the aerodynamic characteristics of a large scale, VTOL, lift fan, jet transport model. The model had two lift fans at the forward portion of the fuselage, a lift fan at each wing tip, and two lift/cruise fans at the aft portion of the fuselage. All fans were driven by tip turbines using T-58 gas generators. Results were obtained for several lift fan, exit vane deflections and lift/cruise fan thrust deflections are zero sideslip. Three component longitudinal data are presented at several fan tip speed ratios. A limited amount of six component data were obtained with asymmetric vane settings. All of the data were obtained without a horizontal tail. Downwash angles at a typical tail location are also presented. Author

N79-22036*# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

EFFECTS OF TURBULENCE ON LAMINAR SEPARATION ON AERODYNAMIC SURFACES SUCH AS AIRFOILS AND COMPRESSOR BLADING Semiannual Status Report, 1 Oct. 1978 - 31 Mar. 1979

Willy Z. Sadeh Apr. 1979 8 p refs

(Grant NsG-3127)

(NASA-CR-158488; CSU-31-1372-1935) Avail: NTIS HC A02/MF A01 CSCL 01A

Activities report include (1) completion of measurements of turbulence amplification in flow about a circular cylinder; (2) initiation of the measurements of turbulence characteristics in flow about a single symmetric airfoil; and, (3) further examination of various matching numerical methods. Emphasis is placed on the experimental program conducted to obtain data on the amplification of the oncoming turbulence and its management. A.R.H

N79-22037*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EXPERIMENTAL INVESTIGATION OF THREE HELICOPTER ROTOR AIRFOILS DESIGNED ANALYTICALLY

Gene J. Bingham and Kevin W. Noonan Apr. 1979 95 p refs Prepared in cooperation with Army Aviation Res. and Develop. Command, Hampton, Va.

(DA Proj. 1L1-61102-AH-45)

(NASA-TP-1396; L-11703; AVRADCOM-TR-79-11) Avail: NTIS HC A05/MF A01 CSCL 01A

Three helicopter rotor airfoils designed analytically were investigated in a wind tunnel at Mach numbers from about 0.30 to 0.90 and Reynolds from about 0.8 to 2.3 x 10 to the 6th power. The airfoils had thickness-to-chord ratios of 0.08, 0.10, and 0.12 with maximum thickness at 40 percent chord. The camber distribution of each section was the same with maximum camber at 35 percent chord. The 10-percent-thick airfoil was also investigated at Reynolds numbers from 4.8 to 9.4 x 10 to the 6th power. The drag divergence Mach number of the 10-percent-thick airfoil is about 0.83 at a normal-force coefficient of 0 and about 0.72 at a normal-force coefficient of 0.6 at Reynolds numbers near 9 x 10 to the 6th power. The maximum normal-force coefficient is slightly less than that of the NACA 0012 airfoil tested in the same facility. The results indicate that a qualitative evaluation of the drag divergence can be made at normal-force coefficients up to the onset of boundary-layer separation by analytically predicting the onset of sonic flow at the airfoil crest. The qualitative results are conservative with respect to experimental values with the experimental drag divergence Mach number up to 0.05 higher than that indicated by analysis. Author

N79-22038*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LOW-SPEED WIND-TUNNEL PARAMETRIC INVESTIGATION OF FLIGHT SPOILERS AS TRAILING-VORTEX-ALLEVIATION DEVICES ON A TRANSPORT AIRCRAFT MODEL

Delwin R. Croom Washington Apr. 1979 46 p refs

(NASA-TP-1419; L-12622) Avail: NTIS HC A03/MF A01 CSCL 01A

The trailing-wing sensor technique was used in the Langley V/STOL tunnel to determine the effectiveness of 11 combinations of the existing flight-spoiler segments on a jumbo-jet transport aircraft model when they were deflected as trailing-vortex-alleviation devices. All 11 of the flight-spoiler configurations investigated were effective in reducing the induced rolling moment on the trailing model. This investigation is an extension of earlier wind-tunnel and flight tests which showed that the existing flight spoilers on the jumbo-jet aircraft can be used as effective trailing-vortex-alleviation devices. Essentially, all of the reduction in induced rolling moment on the trailing-wing model was realized at a spoiler deflection of 45 deg for single-spoiler configurations, 30 for two-spoiler configurations, and 15 deg for both the three- and four-spoiler configurations. Of the 11 flight-spoiler configurations investigated, the most promising configuration for trailing-vortex abatement on the jumbo-jet aircraft appears to be the three inboard flight spoilers deflected 15 deg. A.R.H.

N79-22039*# Boeing Vertol Co., Philadelphia, Pa.

ROTARY-WING AERODYNAMICS. VOLUME 1: BASIC THEORIES OF ROTOR AERODYNAMICS WITH APPLICATION TO HELICOPTERS

W. Z. Stepniewski Washington NASA Jan. 1979 302 p refs

(Contract NAS2-7007)

(NASA-CR-3082) Avail: NTIS HC A14/MF A01 CSCL 01A

The concept of rotary-wing aircraft in general is defined. The energy effectiveness of helicopters is compared with that of other static thrust generators in hover, as well as with various air and ground vehicles in forward translation. The most important aspects of rotor-blade dynamics and rotor control are reviewed. The simple physicomathematical model of the rotor offered by the momentum theory is introduced and its usefulness and limitations are assessed. The combined blade-element and momentum theory approach, which provides greater accuracy in performance predictions, is described as well as the vortex theory which models a rotor blade by means of a vortex filament or vorticity surface. The application of the velocity and acceleration potential theory to the determination of flow fields around three dimensional, non-rotating bodies as well as to rotor aerodynamic problems is described. Airfoil sections suitable for rotors are also considered. A.R.H.

N79-22040*# Battelle Columbus Labs., Ohio.

EXTENDED ANALYTICAL STUDY OF THE FREE-WING/FREE-TRIMMER CONCEPT Final Report

Richard F. Porter, David W. Hall, and Rodolfo D. Vergara Apr.

1979 95 p refs
(Contract NAS4-2498)
(NASA-CR-3135) Avail: NTIS HC A05/MF A01 CSCL 01A

The free wing/free trimmer concept was analytically studied in order to: (1) compare the fore and aft trimmer configurations on the basis of equal lift capability, rather than equal area; (2) assess the influence of tip mounted aft trimmers, both free and fixed, on the lateral directional modes and turbulence responses; (3) examine the feasibility of using differential tip mounted trimmer deflection for lateral control; (4) determine the effects of independent fuselage attitude on the lateral directional behavior; and (5) estimate the influence of wing sweep on dynamic behavior and structural weight. Results indicate that the forward trimmer concept is feasible with the reduced size examined, but it remains inferior to the aft trimmer in every respect except structural weight. Differential motion of the aft trimmer is found to provide powerful lateral control; while the effect of fuselage deck angle is a reduction of the dutch roll damping ratio for nose-down attitudes. J.M.S.

N79-22041*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

BUMBLEBEE PROGRAM: AERODYNAMIC DATA. PART 4: WING LOADS AT MACH NUMBERS 1.5 AND 2.0 Final Report

G. A. Barnes and L. L. Cronvich Washington NASA Apr. 1979 46 p ref
(NASA Order L-60036-A)
(NASA-CR-3117) Avail: NTIS HC A03/MF A01 CSCL 01A

Individual wing panel aerodynamic characteristics are provided for rectangular wings with aspect ratios of 0.25, 0.75, and 1.00 each panel at Mach numbers if 1.5 and 2.0 for angles of attack to 23 degrees. Data plots produced from reports of wind tunnel tests show normal force coefficients, and the spanwise and chordwise center of pressure locations. A.R.H.

N79-22042*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

WIND-TUNNEL FORCE AND FLOW VISUALIZATION DATA AT MACH NUMBERS FROM 1.6 TO 4.63 FOR A SERIES OF BODIES OF REVOLUTION AT ANGLES OF ATTACK FROM MINUS 4 DEG TO 60 DEG

Emma Jean Landrum and C. Donald Babb Mar. 1979 263 p refs
(NASA-TM-78813; L-12639) Avail: NTIS HC A12/MF A01 CSCL 01A

Flow visualization and force data for a series of six bodies of revolution are presented without analysis. The data were obtained in the Langley Unitary Plan wind tunnel for angles of attack from -4 deg to 60 deg. The Reynolds number used for these tests was 6,600,000 per meter. Author

N79-22043*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ONSET OF CONDENSATION EFFECTS WITH AN NACA 0012-64 AIRFOIL TESTED IN THE LANGLEY 0.3-METER TRANSONIC CRYOGENIC TUNNEL

Robert M. Hall Apr. 1979 72 p refs
(NASA-TP-1385; L-12581) Avail: NTIS HC A04/MF A01 CSCL 01A

The onset of condensation effects as determined by varying the stagnation temperature was found to correlate better with the amount of supercooling in the free stream than it did with the supercooling in the region of maximum local Mach number over the air foil. Effects in the pressure distribution over the air foil were seen to appear over its entire length at nearly the same total temperature. Both observations suggest that heterogeneous nucleation does occur in the free stream. The benefits realized from supercooling are presented in terms of increased Reynolds number capability at a given tunnel total pressure and reduced drive-fan power and liquid nitrogen consumption if Reynolds number is held constant. Depending on total pressure and free-stream Mach number, these three benefits are found to vary respectively from 8 to 19 percent, 12 to 24 percent, and 9 to 19 percent. The data analysis and error estimates are given. S.E.S.

N79-22044*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

BUMBLEBEE PROGRAM, AERODYNAMIC DATA. PART 2: FLOW FIELDS AT MACH NUMBER 2.0 Final Report

G. A. Barnes and L. L. Cronvich Apr. 1979 164 p refs
(NASA Order L-60036-A)
(NASA-CR-3115) Avail: NTIS HC A08/MF A01 CSCL 01A

Available flow field data which can be used in validating theoretical procedures for computing flow fields around supersonic missiles are presented. Tabulated test data are given which define the flow field around a conical-nosed cylindrical body in a crossflow plane corresponding to a likely tail location. The data were obtained at a Mach number of 2.0 for an angle of attack of 0 to 23 degrees. The data define the flow field for cases both with and without a forward wing present. Author

N79-22045*# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Physics.

MICROSCOPIC PHENOMENA AND A MODERN APPROACH TO TURBULENCE Final Report, Jun. 1976 - Jul. 1978

Joseph A. Johnson, III, Shen Chen, Lin I, Walter Jones, Raghu Ramaiah, and Jaime Santiago 2 Apr. 1979 86 p refs
(Grant NsG-1314)
(NASA-CR-158499; RU-79-144) Avail: NTIS HC A05/MF A01 CSCL 01A

The use of an arc driven shock tube as a technique in the study of turbulence and evidence to support a kinetic theory of turbulence are described. Topics covered include: (1) reaction rate distortion in turbulent flow; (2) turbulent bursts in a shock tube; (3) driver gas flow with fluctuations; (4) improving the Mach number capabilities of arc driver shock tubes; and (5) resonant absorption in an argon plasma at thermal equilibrium. A.R.H.

N79-22046*# Vought Corp., Hampton, Va.

AERODYNAMIC DESIGN AND ANALYSIS OF THE AST-200 SUPERSONIC TRANSPORT CONFIGURATION CONCEPT

Kenneth B. Walkley and Glenn L. Martin Apr. 1979 47 p refs
(Contract NAS1-13500)
(NASA-CR-159051) Avail: NTIS HC A03/MF A01 CSCL 01A

The design and analysis of a supersonic transport configuration was conducted using linear theory methods in conjunction with appropriate constraints. Wing optimization centered on the determination of the required twist and camber and proper integration of the wing and fuselage. Also included in the design are aerodynamic refinements to the baseline wing thickness distribution and nacelle shape. Analysis to the baseline and revised configurations indicated an improvement in lift-to-drag ratio of 0.36 at the Mach 2.7 cruise condition. Validation of the design is planned through supersonic wing tunnel tests. J.M.S.

N79-22047*# Illinois Inst. of Tech., Chicago.

OBSERVATIONS ON STREAMWISE VORTICES IN LAMINAR AND TURBULENT BOUNDARY LAYERS

Mark V. Morkovin Apr. 1979 8 p ref
(Grant NSG-1120)
(NASA-CR-159061) Avail: NTIS HC A02/MF A01 CSCL 01A

The frequent but often unsuspected presence of streamwise vortices in nominally two dimensional laminar and turbulent boundary layers and some of their consequences are described. Since there is no body of systematic information on streamwise vortices imbedded in boundary layers, a number of issues concerning their occurrence and behavior are discussed in the form of a set of succinct observations. Desirable experimental and numerical research to remedy the current lack of knowledge is recommended. Author

N79-22048*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

EVALUATION OF THE DISCRETE VORTEX WAKE CROSS FLOW MODEL USING VECTOR COMPUTERS. PART 1: THEORY AND APPLICATION

Jan. 1979 102 p refs 2 Vol.
(Contract NAS2-9579)

(NASA-CR-152270; TRW-30584-6001-RU-00-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 01A

The current program had the objective to modify a discrete vortex wake method to efficiently compute the aerodynamic forces and moments on high fineness ratio bodies (f approximately 10.0). The approach is to increase computational efficiency by structuring the program to take advantage of new computer vector software and by developing new algorithms when vector software can not efficiently be used. An efficient program was written and substantial savings achieved. Several test cases were run for fineness ratios up to f = 16.0 and angles of attack up to 50 degrees. G.Y.

N79-22049*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

EVALUATION OF THE DISCRETE VORTEX WAKE CROSS FLOW MODEL USING VECTOR COMPUTERS. PART 2: USER'S MANUAL FOR DIVORCE

F. D. Deffenbaugh and J. F. Vitz Jan. 1979 70 p refs 2 Vol.

(Contract NAS2-9579)

(NASA-CR-152271; TRW-30584-6002-RU-00-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 01A

The users manual for the Discrete Vortex Cross flow Evaluator (DIVORCE) computer program is presented. DIVORCE was developed in FORTRAN 4 for the DCD 6600 and CDC 7600 machines. Optimal calls to a NASA vector subroutine package are provided for use with the CDC 7600. G.Y.

N79-22050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SURFACE PRESSURE DATA ON A SERIES OF CONICAL FOREBODIES AT MACH NUMBERS FROM 1.70 TO 4.50 AND COMBINED ANGLES OF ATTACK AND SIDESLIP

James C. Townsend, Ida K. Collins, Dorothy T. Howell, and Clyde Hayes Mar. 1979 446 p ref

(NASA-TM-78808) Avail: NTIS HC A20/MF A01 CSCL 01A

Tabulated surface pressure data for a series of forebodies which have analytically defined cross sections and are based on a 20 degs half-angle cone are presented without analysis. Five of the cross sections were ellipses having axis ratios of 3/1, 2/1, 1/1, 1/2, and 1/3. The sixth cross section was defined by a curve having a single lobe. The data generally cover angles of attack from -5 degs to 20 degs at angles of sideslip from 0 degs to 5 degs for Mach numbers of 1.70, 2.50, 3.95, and 4.50 at a constant Reynolds number. Author

N79-22051*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SURFACE PRESSURE DATA FOR A SUPERSONIC-CRUISE AIRPLANE CONFIGURATION AT MACH NUMBERS OF 2.30, 2.96, 3.30

Barrett L. Shrout, William A. Corlett, and Ida K. Collins May 1979 56 p refs

(NASA-TM-80061; L-12777) Avail: NTIS HC A04/MF A01 CSCL 01A

The tabulated results of surface pressure tests conducted on the wing and fuselage of an airplane model in the Langley Unitary Plan wind tunnel are presented without analysis. The model tested was that of a supersonic-cruise airplane with a highly swept arrow-wing planform, two engine nacelles mounted beneath the wing, and outboard vertical tails. Data were obtained at Mach numbers of 2.30, 2.96, and 3.30 for angles of attack from -4 deg to 12 deg. The Reynolds number for these tests was 6,560,000 per meter. Author

N79-22052*# United Technologies Research Center, East Hartford, Conn.

THE INFLUENCE OF SWEEP ON THE AERODYNAMIC LOADING OF AN OSCILLATING NACA 0012 AIRFOIL. VOLUME 1: TECHNICAL REPORT Final Report

A. O. St.Hilaire, F. O. Carta, M. R. Fink, and W. D. Jepson (Sikorsky Aircraft) May 1979 138 p refs

(Contract NAS1-14873)

(NASA-CR-3092) Avail: NTIS HC A07/MF A01 CSCL 01A

Aerodynamic experiments were performed on an oscillating NACA 0012 airfoil utilizing a tunnel-spanning wing in both unswept and 30 degree swept configurations. The airfoil was tested in steady state and in oscillatory pitch about the quarter chord. The unsteady aerodynamic loading was measured using pressure transducers along the chord. Numerical integrations of the unsteady pressure transducer responses were used to compute the normal force, chord force, and moment components of the induced loading. The effects of sweep on the induced aerodynamic load response was examined. For the range of parameters tested, it was found that sweeping the airfoil tends to delay the onset of dynamic stall. Sweeping was also found to reduce the magnitude of the unsteady load variation about the mean response. It was determined that at mean incidence angles greater than 9 degrees, sweep tends to reduce the stability margin of the NACA 0012 airfoil; however, for all cases tested, the airfoil was found to be stable in pure pitch. Turbulent eddies were found to convect downstream above the upper surface and generate forward-moving acoustic waves at the trailing edge which move upstream along the lower surface. J.M.S.

N79-22053# Naval Postgraduate School, Monterey, Calif.

A DISCRETE VORTEX ANALYSIS OF FLOW ABOUT STATIONARY AND TRANSVERSELY OSCILLATING CIRCULAR CYLINDERS Interim Report, Sep. 1977 - Dec. 1978

Turgut Sarpkaya and R. L. Shoaff Jan. 1979 166 p refs

(AD-A064269; NPS-69SL79011) Avail: NTIS HC A08/MF A01 CSCL 20/4

A comprehensive numerical model has been developed to investigate the characteristics of flow about a circular cylinder undergoing synchronized transverse oscillations. The model is based on the rediscretization of the shear layers, wake-boundary-layer interaction, and the dissipation of vorticity. The forces acting on the cylinder, rate of vorticity flux, Strouhal number, cylinder response, oscillations of the stagnation and separation points, longitudinal and transverse spacing of the vortices, and the base pressure have been calculated and shown to be in conformity with those obtained experimentally. The model has been used to predict the characteristics of hydroelastic oscillations of a cylinder in the range of synchronization. The numerical experiments shed considerable light on the interaction between the fluid motion in the wake and the dynamics of the body. An extensive sensitivity analysis has been carried out to determine the stability of all the parameters, and hence, the stability of the numerical model itself. Author (GRA)

N79-22054# Ballistic Research Labs., Aberdeen Proving Ground, Md.

SURFACE PRESSURE MEASUREMENTS ON SLENDER BODIES AT ANGLE OF ATTACK IN SUPERSONIC FLOW Final Report

Robert P. Reklis and Walter B. Sturek Nov. 1978 66 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A064097; AD-E430171; ARBRL-MR-02876) Avail: NTIS HC A04/MF A01 CSCL 20/4

Measurements of wall static pressure on the surface of bodies with both secant and tangent ogive noses and with both straight tails and boattails are reported. Data were taken at three supersonic Mach numbers (2, 3, and 4) and at six angles of attack (0, 1, 2, 4, 6, and 10 degs). Pressure data were obtained at ten longitudinal stations along the models. The models were rolled to obtain data at azimuthal positions every 10 degs about the body. Some comparisons of the data with numerical computations based on inviscid theory are given. These comparisons show good agreement at small angles of attack.

Author (GRA)

N79-22055# Boeing Vertol Co., Philadelphia, Pa.

INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 4-C: ONE-THIRD OCTAVE BAND SPECTROGRAMS OF WAKE SPLIT-FILM DATA, SOLID HUBCAPS Final Report, 15 Mar. 1977 - 13 Feb. 1978

Philip F. Sheridan Sep. 1978 257 p

(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)

(AD-A063801; USARTL-TR-78-23D-Vol-4-C) Avail: NTIS HC A12/MF A01 CSCL 20/4

This is the third of seven sub-volumes of Volume IV containing one-third octave band spectrographs of the model helicopter hub/rotor wake as it was modified by various aerodynamic devices.

This sub-volume deals with the effects of solid hub caps. Here the cap underside is flat and does not share the upperside camber. Author (GRA)

N79-22056# Pennsylvania State Univ., State College. Applied Research Lab.

SECONDARY-FLOW-RELATED VORTEX CAVITATION

M. L. Billet 5 Jul. 1978 202 p refs

(Contract N00024-79-C-6043; SR023101)

(AD-A064708; ARL/PSU-TM-78-189) Avail: NTIS HC A10/MF A01 CSCL 20/4

A study is presented of a vortex formed near the inner wall of a rotor operating within a boundary layer. Experimental critical cavitation data and Laser Doppler Anomometer measurements obtained downstream of the rotor plane are given for many flow configurations. In addition, rotor inlet and outlet velocity profiles were measured. Experimental results show an influence of inlet velocity gradient near the inner wall on the critical cavitation number of the vortex. Secondary flow vorticity equations are developed and employed to calculate the vorticity in the blade passage near the inner wall of a rotor. In order to calculate the streamwise vorticity, an approximate method was developed to calculate the streamlines through a rotor. Cavitation data are correlated with the calculated exit passage streamwise vorticity using a simple vortex model. Results show the importance of the additional secondary vorticity on the exit streamwise vorticity near the inner wall of a rotor. The secondary vorticity induces an additional component of tangential velocity which was found to increase the flow turning near the inner wall. This increased tangential velocity profile compared favorably with the measured vortex profile outside of the vortex core region. Author (GRA)

N79-22057# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

AERODYNAMIC CHARACTERISTICS OF THE CLOSE-COUPLED CANARD AS APPLIED TO LOW-TO-MODERATE SWEPT WINGS. VOLUME 1: GENERAL TRENDS Final Report, 1970 - 1974

David W. Lacey Jan. 1979 68 p ref

(WF1412109)

(AD-A063819; AERO-1256-Vol-1; DTNSRDC-79-001-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 01/3

A summary of the general findings of close-coupled canard research at David W. Taylor Naval Ship Research and Development Center is presented. These findings are based on a series of wind-tunnel evaluations utilizing an aircraft research model having wings of either 25 or 50 degree leading edge sweep. Discussed is the effect of canard placement on lift, drag, and pitching moment and the location of optimum position for canards of different planform. In addition, the effects of canard-wing interference, canard deflection, size, and Mach number are described. Author (GRA)

N79-22058# Vought Corp. Advanced Technology Center, Inc., Dallas, Tex.

VALIDATION OF A TRANSONIC MANEUVER/CRUISE AIRFOIL DESIGN EMPLOYING ACTIVE DIFFUSION CONTROL Final Report, 29 Jun. 1976 - 31 Dec. 1977

C. H. Haight and R. L. Mask 23 Jun. 1978 70 p refs

(Contract N62269-76-C-0318)

(AD-A064320; ATC-B-91100/8CR-84) Avail: NTIS HC A04/MF A01 CSCL 01/3

The use of advanced active diffusion control resulted in cruise and maneuvering transonic airfoil design points which are similar enough to permit deployment from a common section while still achieving outstanding performance at both flight conditions. An airfoil thickness ratio of seven percent was selected, relating to high performance aircraft/missile applications. The antiseparation tailored contour (ATC) is the basic blowing/contouring device for active diffusion control. A design phase produced transonic ATC cruise and maneuvering airfoil geometries designated as TATC7C and TATC7M, respectively. Corresponding predictions of significant performance improvements motivated entry into model fabrication and wind tunnel testing tasks. The high Mach number design point performance of a variable geometry transonic section employing active diffusion control indicates the potential for unique performance and efficiency advantages in advanced airfoil design. GRA

N79-22059# Naval Research Lab., Washington, D. C.

AERODYNAMIC COEFFICIENT DERIVATIVES OF SONIC MISSILES VIA SLENDER BODY THEORY Final Report

Ronald M. Brown 10 Jan. 1979 28 p refs

(AD-A064687; AD-E000265; NRL-8203) Avail: NTIS HC A03/MF A01 CSCL 20/4

This investigation was initiated to develop analytic procedures for estimating aerodynamic coefficient derivatives for missiles. The analytic estimates will depend primarily on the geometrical configurations of the missiles. The problem of determining the coefficient derivatives becomes reasonably tractable for thin airfoil-body combinations with moderate finite aspect ratios and flying at sonic speeds. Starting with the equations for a perfect gas, a linearization of them is achieved by assuming flow over a thin profile. A further assumption of a speed of Mach 1 gives rise to slender body theory. The problem is thus reduced to a potential boundary value problem in a cross-flow plane. Upon consideration of the total momentum in a cross-flow slab, it is found that the resultant lateral force may be expressed as a countour integral of the velocity potential. The effects of missile angle of attack and control-surface angle are incorporated by way of Neumann-type conditions on the boundary contour. For the special case where the missile cross section is a circle with midwing, there is an analytic solution for the potential-flow problem. For the case where there is an arbitrary missile cross section, a computer program has been developed which addresses the problem using a source distribution approach. Results are given for several sample cross sections. It is shown how the cross-flow results may be applied to a typical missile configuration to obtain the aerodynamic coefficient derivatives. Author (GRA)

N79-22060# Calspan Advanced Technology Center, Buffalo, N. Y.

STUDIES OF THE EFFECTS OF TRANSITIONAL AND TURBULENT BOUNDARY LAYERS ON THE AERODYNAMIC PERFORMANCE OF HYPERSONIC REENTRY VEHICLES IN HIGH REYNOLDS NUMBER FLOWS Final Report, 1 Oct. 1975 - 30 Nov. 1977

Michael S. Holden Dec. 1978 295 p refs

(Contract F44620-76-C-0037)

(AD-A065173; CALSPAN-AB-5834-A-2; AFOSR-79-0125TR) Avail: NTIS HC A13/MF A01 CSCL 20/4

This report describes a series of studies to investigate the underlying aero-thermodynamic phenomena which influence the accuracy and survivability of Ballistic Reentry Vehicles. The influence of transition on the aerodynamic characteristics of slender RV's is discussed first. Here the primary interest was in determining the influence of the angle of attack and bluntness ratio on the shape of the transition front and the properties of these regions. A detailed study was made of the influence of asymmetric nose bluntness on the pressure and heat transfer distribution over the cone frustum, and the contribution of the cone frustum to the forces and moments experienced by the total configuration. Particular emphasis was placed on determining the destabilizing effect of the NRV and RTE nose shapes recovered from flight tests. It was found that nose shaping can significantly change the pressure distribution over the conical frustum relative to a spherically-capped configuration; this effect must be accounted for if accurate predictions of cone stability at low altitude are required. Detailed heat transfer and pressure measurements made on a model of the NRV nose shape for test conditions indicated that regions of flow separation and shock wave boundary-layer interaction were induced over this configuration and produced heating rates in the reattachment regions on the ablated conical frustum of up to three times those recorded at the stagnation point on the spherical nose tip. GRA

N79-21997# National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Lab.

EFFECT OF HIGH ANGLES OF ATTACK ON DYNAMIC STABILITY PARAMETERS

K. J. Orlik-Rueckemann *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 14 p refs (For primary document see N79-21996 13-01)

Avail: NTIS HC A23/MF A01

N79-22001# Northrop Corp., Hawthorne, Calif. Aerodynamics Research Dept.
FOREBODY/WING VORTEX INTERACTIONS AND THEIR INFLUENCE ON DEPARTURE AND SPIN RESISTANCE
A. M. Skow, A. Titiriga, Jr., and W. A. Moore *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 26 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22002# Royal Aircraft Establishment, Farnborough (England).
STRAKE-INDUCED SEPARATION FROM THE LEADING EDGES OF WINGS OF MODERATE SWEEP
S. P. Fiddes and J. H. B. Smith *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 12 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22003# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
AERODYNAMIC CHARACTERISTICS OF A FIGHTER-TYPE CONFIGURATION DURING AND BEYOND STALL
W. Staudacher, B. Laschka, P. Poisson-Quinton (ONERA, Paris, France), and J. P. Ledy (ONERA, Paris, France) *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 15 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22007# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VORTEX PATTERN DEVELOPING ON THE UPPER SURFACE OF A SWEPT WING AT HIGH ANGLE OF ATTACK
Jean Mirande, Volker Schmitt, and Henri Werle *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 18 p refs In FRENCH; ENGLISH summary (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.
STABLE AND UNSTABLE VORTEX SEPARATION
Erich H. Wedemeyer *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22009# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTEADY CALCULATION OF VORTEX SHEETS EMITTED BY HIGHLY LOADED LIFTING SURFACES
Colmar Rehback *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 9 p refs In FRENCH; ENGLISH summary (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22010# Technische Universitaet, Brunswick (West Germany). Inst. fuer Stroemungsmechanik.
ON THE VORTEX FORMATION OVER A SLENDER WING AT LARGE ANGLES OF INCIDENCE
Dietrich Humnel *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 17 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22011*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SYMMETRICAL AND ASYMMETRICAL SEPARATIONS ABOUT A YAWED CONE
David J. Peake, F. Kevin Owen (Owen Intern., Inc., Palo Alto, Calif.), and Hiroshi Higuchi (Dyn. Technol., Inc., Torrance, Calif.) *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 27 p refs (For primary document see N79-21996 13-01)
(Contract NAS2-9663)
Avail: NTIS HC A23/MF A01 CSCL 01A

N79-22012# Bristol Univ. (England). Dept. of Aeronautical Engineering.
PRESSURES ON A SLENDER BODY AT HIGH ANGLE OF ATTACK IN A VERY LOW TURBULENCE LEVEL AIR STREAM
B. L. Hunt and P. C. Dexter *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 14 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22013# British Aerospace Dynamics Group, Bristol (England). Aerodynamics Research Group.
WIND AND WATER TUNNEL INVESTIGATIONS OF THE INTERACTION OF BODY VORTICES AND THE WING PANELS OF A MISSILE CONFIGURATION
J. R. Deane *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 18 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22014# S. A. Engins Matra, Velizy (France).
AERODYNAMIC CHARACTERISTICS OF BODIES OF REVOLUTION EQUIPPED WITH WINGS OF VARIOUS ASPECT RATIOS [CHARACTERISTIQUES AERODYNAMICS DES CORPS DE REVOLUTION MUNIS D'AILES D'ALLONGEMENTS DIVERS]
L. Mifsud *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 24 p refs In FRENCH; ENGLISH summary (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22015# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMIC CHARACTERISTICS OF A MISSILE FEATURING WING WITH STRAKES AT HIGH ANGLES OF ATTACK
M. Akcav, B. E. Richards (DFVLR, Goettingen, West Ger.), W. Stahl, and A. Zarghami *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 7 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22016# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
ON THE LEE-SIDE FLOW OVER DELTA WINGS AT HIGH ANGLE OF ATTACK
Joachim Szodruch and Uwe Ganzer *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 7 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22017# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
MEASUREMENTS OF THE SUPERSONIC FLOW FIELD PAST A SLENDER CONE AT HIGH ANGLES OF ATTACK
W. J. Bannink and C. Nebbeling *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 15 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22018*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL SIMULATION OF SUPERSONIC CONE FLOW AT HIGH ANGLE OF ATTACK
David S. McRae and M. Y. Hussaini (NASA Langley Res. Center) *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)
(Contracts NAS1-1410; NAS1-14472)
Avail: NTIS HC A23/MF A01 CSCL 01A

N79-22019*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RECENT THEORETICAL DEVELOPMENTS AND EXPERIMENTAL STUDIES PERTINENT TO VORTEX FLOW AERODYNAMICS, WITH A VIEW TOWARDS DESIGN
John E. Lamar and James M. Luckring *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 31 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

N79-22020# National Aerospace Lab., Amsterdam (Netherlands).
A COMPUTATIONAL MODEL FOR THE CALCULATION OF THE FLOW ABOUT WINGS WITH LEADING-EDGE VORTICES
H. W. M. Hoeijmakers and B. Bennekers *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 11 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22021# Boeing Aerospace Co., Seattle, Wash.
SUBCRITICAL DRAG MINIMIZATION FOR HIGHLY SWEPT WINGS WITH LEADING EDGE VORTICES
E. N. Tinoco and H. Yoshihara *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 9 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22023*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTION OF AERODYNAMIC CHARACTERISTICS FOR SLENDER BODIES ALONE AND WITH LIFTING SURFACES TO HIGH ANGLES OF ATTACK
Leland H. Jorgensen *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 40 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

N79-22024# Nielsen Engineering and Research, Inc., Mountain View, Calif.
PREDICTION OF LATERAL AERODYNAMIC LOADS ON AIRCRAFT AT HIGH ANGLES OF ATTACK
S. B. Spangler, S. C. Perkins, Jr., and M. R. Mendenhall *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 14 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22025# Systems Research Labs., Inc., Newport News, Va.
PREDICTION AND MEASUREMENT OF THE AERODYNAMIC FORCES AND PRESSURE DISTRIBUTIONS OF WING-TAIL CONFIGURATIONS AT VERY HIGH ANGLES OF ATTACK
Richard P. White, Jr. *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 16 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22028# Texas Univ. at Austin. Dept. of Mechanical Engineering.
COMPRESSIBILITY EFFECTS ON THE SYMMETRIC BODY VORTEX WAKE OF AN OGIVE NOSE CYLINDER
William L. Oberkampf and Timothy J. Bartel *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 4 p refs (For primary document see N79-21996 13-01)
(Contract F08635-77-C-0049)
Avail: NTIS HC A23/MF A01

N79-22029# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Aeronautics.
WIND TUNNEL TEST AT LOW SPEEDS OF A DORSAL AIR INTAKE ON A FIGHTER CONFIGURATION
Sven-Olof Ridder *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 3 p (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22030# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
VISUALISATIONS AND CALCULATIONS OF AIR INTAKES AT HIGH ANGLES OF ATTACK AND LOW REYNOLDS NUMBER
P. C. Perrier and J. Periaux *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 2 p refs In FRENCH (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22031# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
STATE OF ART OF NONLINEAR, DISCRETE-VORTEX METHODS FOR STEADY AND UNSTEADY HIGH ANGLE OF ATTACK AERODYNAMICS
Osama A. Kandil *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 5 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22032# Bristol Univ. (England). Dept. of Aeronautical Engineering.
ON SLENDER WINGS WITH LEADING EDGE CAMBER
R. K. Nangia *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22033# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE ENTRAINMENT OF A LEADING-EDGE VORTEX
N. G. Verhaagen and L. vanderSnoek *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 5 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22034# Aeritalia S.p.A., Torino (Italy). Combat Aircraft Div.
A SURVEY OF RECENT HIGH ANGLE OF ATTACK; WIND TUNNEL TESTING AT AERITALIA
G. Bucciantini, R. DeSilvestro, and L. Fornaster *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 4 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N79-22061*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEMAND FOR LARGE FREIGHTER AIRCRAFT AS PROJECTED BY THE NASA CARGO/LOGISTICS AIRLIFT SYSTEM STUDIES
Allen H. Whitehead, Jr. and William H. Kuhlman (McDonnel-Douglas Corp.) Apr. 1979 34 p refs Presented at the AIAA Very Large Vehicle Conf., Arlington, Va., 26-27 Apr. 1979
(NASA-TM-80074) Avail: NTIS HC A03/MF A01 CSCL 01C

The market conditions are examined up through the year 2008 to provide a preliminary assessment of the potential for and the characteristics of an advanced, all-cargo transport aircraft. Any new freighter must compete with current wide-body aircraft and their derivatives. Aircraft larger than the wide-bodies may incur economic penalties and operational problems. A lower direct operating cost is not a sufficient criterion to base a decision for the initiation of a new aircraft development or to select aircraft characteristics. Other factors of equal importance that are reviewed in this paper include considerations of the system infrastructure, the economics of the airlines, and the aircraft manufacturer return on investment. The results of the market forecast and a computer simulation show that an advanced long range aircraft with a payload between 68 to 181 tonnes (75 to 200 tons) could generate a solid foothold beginning around 1994. L.S.

N79-22062*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
AN ANALYSIS OF LONG AND MEDIUM-HAUL AIR PASSENGER DEMAND, VOLUME 1 Final Report
Steven E. Eriksen 1978 75 p refs
(Grant NsG-2129)
(NASA-CR-152156) Avail: NTIS HC A04/MF A01 CSCL 05C

A basic model was developed which is a two equation pair

econometric system in which air passenger demand and airline level-of-service are the endogenous variables. The model aims to identify the relationship between each of these two variables and its determining factors, and to identify the interaction of demand and level-of-service with each other. The selected variable for the measure of air passenger traffic activity in a given pair market is defined as the number of passengers in a given time that originate in one region and fly to the other region for purposes other than to make a connection to a third region. For medium and long haul markets, the model seems to perform better for larger markets. This is due to a specification problem regarding the route structure variable. In larger markets, a greater percentage of nonlocal passengers are accounted for by this variable. Comparing the estimated fare elasticities of long and medium haul markets, it appears that air transportation demand is more price elastic in longer haul markets. Long haul markets demand will saturate with a fewer number of departures than will demand in medium haul markets. A.R.H.

N79-22063*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

AN ANALYSIS OF SHORT HAUL AIR PASSENGER DEMAND, VOLUME 2 Final Report

Terry P. Blumer and William M. Swan 1978 132 p refs (Grant NsG-2129)

(NASA-CR-152157) Avail: NTIS HC A07/MF A01 CSCL 05C

Several demand models for short haul air travel are proposed and calibrated on pooled data. The models are designed to predict demand and analyze some of the motivating phenomena behind demand generation. In particular, an attempt is made to include the effects of competing modes and of alternate destinations. The results support three conclusions: (1) the auto mode is the air mode's major competitor; (2) trip time is an overriding factor in intermodal competition, with air fare at its present level appearing unimportant to the typical short haul air traveler; and (3) distance appears to underly several demand generating phenomena, and therefore, must be considered very carefully to any intercity demand model. It may be the cause of the wide range of fare elasticities reported by researchers over the past 15 years. A behavioral demand model is proposed and calibrated. It combines the travel generating effects of income and population, the effects of modal split, the sensitivity of travel to price and time, and the effect of alternative destinations satisfying the trip purpose. A.R.H.

N79-22064*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

AN ECONOMIC MODEL OF THE MANUFACTURERS' AIRCRAFT PRODUCTION AND AIRLINE EARNINGS POTENTIAL, VOLUME 3 Final Report

James T. Kneafsey and Richard M. Hill 1978 185 p refs (Grant NsG-2129)

(NASA-CR-152158) Avail: NTIS HC A09/MF A01 CSCL 05C

A behavioral explanation of the process of technological change in the U. S. aircraft manufacturing and airline industries is presented. The model indicates the principal factors which influence the aircraft (airframe) manufacturers in researching, developing, constructing and promoting new aircraft technology; and the financial requirements which determine the delivery of new aircraft to the domestic trunk airlines. Following specification and calibration of the model, the types and numbers of new aircraft were estimated historically for each airline's fleet. Examples of possible applications of the model to forecasting an individual airline's future fleet also are provided. The functional form of the model is a composite which was derived from several preceding econometric models developed on the foundations of the economics of innovation, acquisition, and technological change and represents an important contribution to the improved understanding of the economic and financial requirements for aircraft selection and production. The model's primary application will be to forecast the future types and numbers of new aircraft required for each domestic airline's fleet. A.R.H.

N79-22065*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

THE IMPACT OF CHANGING TECHNOLOGY ON THE DEMAND FOR AIR TRANSPORTATION Final Report

James T. Kneafsey and Nawal K. Taneja 1978 27 p refs (Grant NsG-2129)

(NASA-CR-152191) Avail: NTIS HC A03/MF A01 CSCL 05C

Demand models for air transportation that are sensitive to the impact of changing technology were developed. The models are responsive to potential changes in technology, and to changing economic, social, and political factors as well. In addition to anticipating the wide differences in the factors influencing the demand for long haul and short haul air travel, the models were designed to clearly distinguish among the unique features of these markets. J.M.S.

N79-22066# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

LIGHTNING TRANSIENT RESEARCH ON AN F-111E AIRCRAFT Final Report, Jun. - Dec. 1976

Vernon L. Mangold and Lawrence C. Walko Feb. 1978 105 p refs

(AD-A063765; AFFDL-TR-78-1) Avail: NTIS HC A06/MF A01 CSCL 01/2

A simulated lightning test was conducted on an F-111E aircraft (S/N 67-116A) to field test improved measurement techniques and to record and evaluate induced transient voltages on selected electrical circuits to determine their susceptibility to lightning. Technical improvements included (1) a pneumatic system to trigger the simulated lightning current-producing capacitor bank, (2) a change in configuration of current return leads, (3) specially designed breakout boxes and cables, (4) a fiber optics measurement system, and (5) a Tektronix transient digitizer data recording system. The standard 2 x 50 microsecond current pulse was applied to the aircraft (nose-to-tail) and induced voltages were measured and recorded both in the time and frequency domains on 17 different circuits with power off in the aircraft. The magnitude of the current pulse was varied from 0.5 to 5.5 kiloamperes, but most measurements were made at 2.5 kiloamperes. Measurements were made on flight critical circuits of the Altitude-Vertical Speed amplifiers, the Yaw and Roll computers, and the Roll Rate Gyro in the Feel and Trim assembly, on the tail light and right and left wing position light circuits, on the fuel indication circuits, and on the pitot heater circuit (with and without a transient suppressor device). Power-on measurements made on four damper servo circuits resulted in substantially higher induced voltage amplitudes than with power off. Changing aircraft ground points did not affect the magnitude or waveshape of induced transients. GRA

N79-22067# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

TEST AND EVALUATION OF MODIFIED HIGH PERFORMANCE JET AIRCREW LIFE PRESERVER

J. A. Firth and J. C. Steffler Nov. 1978 22 p refs

(AD-A063959; DCIEM-TR-78X36) Avail: NTIS HC A02/MF A01 CSCL 06/7

At the request of NDHQ, DCIEM evaluated several proposed Automatic Inflation Device (AID) pocket modifications for the high performance jet aircrew life preserver. Two Irvin proposals and two modified pockets developed at DCIEM were compared with the existing AID pocket in terms of manual pull force and automatic inflation times. Although no significant differences were noted between the four prototypes, an improved AID pocket resulting from DCIEM/DAES collaboration was considered best suited for CF use. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N79-22068*# Systems Control, Inc., West Palm Beach, Fla.

GENERAL AVIATION IFR OPERATIONAL PROBLEMS

Eric H. Bolz and Janice E. Eisele Apr. 1979 218 p refs
(Contract NAS1-15313)
(NASA-CR-159022) Avail: NTIS HC A10/MF A01 CSCL 17G

Operational problems of general aviation IFR operators (particularly single pilot operators) were studied. Several statistical bases were assembled and utilized to identify the more serious problems and to demonstrate their magnitude. These bases include official activity projections, historical accident data and delay data, among others. The GA operating environment and cockpit environment were analyzed in detail. Solutions proposed for each of the problem areas identified are based on direct consideration of currently planned enhancements to the ATC system, and on a realistic assessment of the present and future limitations of general aviation avionics. A coordinated set of research program is suggested which would provide the developments necessary to implement the proposed solutions. A.R.H.

N79-22069# Norwegian Defence Research Establishment, Kjeller.
FACTORS AFFECTING OMEGA ACCURACY
T. R. Larsen, E. R. Swanson (Naval Ocean Systems Center, San Diego, Calif.), and E. V. Thrane Dec. 1978 32 p refs Sponsored in part by ONR
(NDRE-71; ISSN-0085-4301) Avail: NTIS HC A03/MF A01

Factors affecting the navigational accuracy of Omega include system geometry, phase prediction models, phase measureability and signal phase repeatability. A discussion of these subjects is given with emphasis on the latter topic. Experimental phase data from Omega monitoring at high latitudes are presented. The effects of solar X-ray flares and solar proton events on Omega positional accuracy are evaluated. Author

N79-22070# Old Dominion Systems, Inc., Gaithersburg, Md.
USER'S GUIDE TO DATA PREPARATION: PHOTOGRAMMETRIC NAVIGATION ANALYSIS PROGRAM FOTONAP
Georg E. Morduch and David A. Bergeron Sep. 1978 123 p
(Contract DAAK70-77-C-0254)
(AD-A064614; ETL-0174) Avail: NTIS HC A06/MF A01 CSCL 17/7

This report is a user's guide for the photogrammetric navigation analysis program (generally referred to as fotonap) designed to provide the user with a detailed description of the control information needed to run fotonap. Author (GRA)

N79-22071# Old Dominion Systems, Inc., Gaithersburg, Md.
KALMAN FILTERING AND SMOOTHING IN FOTONAP FOR ORBIT DETERMINATION USING GPS MEASUREMENTS Final Report
Georg E. Morduch and David A. Bergeron Sep. 1978 139 p refs
(Contract DAAK70-77-C-0254)
(AD-A064613; ETL-0161) Avail: NTIS HC A07/MF A01 CSCL 17/7

The Fotonap program has been modified to incorporate a Kalman filter and a fixed lag smoother, the capability to handle GPS measurements through the filter/smoother, a Lockheed-Jacchia dynamic atmospheric model, a discretely changing atmospheric drag coefficient (drag segmentation), and the capability to accept as input to the regular Fotonap the output from the filter/smoother including the full covariance matrix. The derivation of all the required equations is given in this report. Updated versions of Fotonap exist for both CDC 6400 and Univac 1108 computers. GRA

N79-22072# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ERROR MODEL VERIFICATION FOR A THREE AXIS LASER GYRO STRAPDOWN INERTIAL MEASUREMENT UNIT M.S. Thesis
Robert S. Lawrence Dec. 1978 100 p refs
(AD-A064047; AFIT/GGC/EE/78-8) Avail: NTIS HC A05/MF A01 CSCL 17/7

A digital data acquisition system was developed to obtain data from a Sperry laser gyroscope strapdown inertial measurement unit for error model verification. The system consisted of a laboratory test set-up with the inertial measurement unit (IMU) on the Genisco rate table and input/output interfaces such that meaningful IMU sensor data was recorded on magnetic tape with absence of a microprocessor. The recorded data was processed on the CDC 6600 digital computer by a specially developed program which formats the data in accordance to desired specifications. The calibration sequence for error model verification was a 6-position dynamic test for the laser gyros and a 6-position static test for the accelerometers. The result is a reliable and flexible system that can obtain data from the IMU in the laboratory for analysis. Author (GRA)

N79-22073# Air Force Global Weather Central, Offutt AFB, Nebraska.
ENVIRONMENTAL EFFECTS ON VLF NAVIGATION SYSTEMS, OMEGA
Edward D. Beard Dec. 1978 32 p refs
(AD-A063882; AFGWC-TM-78-004) Avail: NTIS HC A03/MF A01 CSCL 17/7

Very Low Frequency (VLF) (3-30 khz) radio waves are exceptionally useful for long range navigation systems such as the OMEGA. Anomalies in the earth's upper atmosphere, specifically the ionosphere, can introduce significant errors into these systems. The technical memorandum describes these anomalies and introduces the products available from AFGWC which may help the navigator to better utilize the navigation system. Author (GRA)

N79-22074# Naval Surface Weapons Center, Dahlgren, Va.
AN EFFICIENT ALGORITHM FOR COMPUTING THE Q-GUIDANCE MATRIX Final Report
William L. Davis Jan. 1979 34 p
(AD-A064816; NSWC/DL-TR-3844) Avail: NTIS HC A03/MF A01 CSCL 17/7

This paper derives a new method for computing the Q-guidance matrix. This matrix is defined as the derivative with respect to position of the correlated velocity V sub C; i.e., the velocity required to reach a given target in a specified time in an inverse-square gravitational field. The method is completely analytic and yields a simple and efficient algorithm. The analytic equation for the partial derivative of the horizontal component of correlated velocity with respect to range angle developed here is also of independent interest. To the author's knowledge, no such expression for this quantity in terms of the given conditions and the components of V sub C has been derived previously. This equation, in conjunction with the others given here, makes it possible to compute virtually any (first order) derivative of V sub C of interest. The Q-matrix algorithm is of use primarily in the analysis and modeling of guidance systems using some form of V sub G steering. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-22075*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF INTEGRATED PROGRAMS FOR AEROSPACE-VEHICLE DESIGN (IPAD): PRODUCT MANUFACTURE INTERACTIONS WITH THE DESIGN PROCESS Final Report
H. A. Crowell Mar. 1979 166 p refs
(Contract NAS1-14700)
(NASA-CR-2982; D6-IPAD-70011-D) Avail: NTIS HC A08/MF A01 CSCL 01C

The product manufacturing interactions with the design process and the IPAD requirements to support the interactions are described. The data requirements supplied to manufacturing by design are identified and quantified. Trends in computer-aided manufacturing are discussed and the manufacturing process of the 1980's is anticipated. A.R.H.

N79-22076*# Boeing Vertol Co., Philadelphia, Pa.
IDENTIFICATION OF HIGH PAYOFF RESEARCH FOR MORE EFFICIENT APPLICATOR HELICOPTERS IN AGRICULTURE AND FORESTRY
Kenneth T. Waters May 1979 84 p refs
(Contract NAS2-10040)
(NASA-CR-152258; D210-11193-1) Avail: NTIS HC A06/MF A01 CSCL 01C

The results of a study of the uses of helicopters in agriculture and forestry in the United States are discussed. Comparisons with agricultural airplanes are made in terms of costs of aerial application to the growers. An analysis of cost drivers and potential improvements to helicopters that will lower costs is presented. Future trends are discussed, and recommendations for research are outlined. Operational safety hazards and accident records are examined, and problem areas are identified. Areas where research and development are needed to provide opportunities for lowering costs while increasing productivity are analyzed.
Author

N79-22077# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
ENGINEER DESIGN TEST 1, HUGHES YAH-64, ADVANCED ATTACK HELICOPTER Final Report
Richard C. Tarr, Robert L. Stewart, Ralph Woratschek, and Vernon L. Diekmann Sep. 1978 158 p refs
(AD-A064359; USAAEFA-77-36) Avail: NTIS HC A08/MF A01 CSCL 01/3

A Handling Qualities Evaluation, Engineer Design Test 1, was conducted of the Hughes Helicopter Company YAH-64 advanced attack helicopter from 22 April 1978 through 1 May 1978 at Palomar Airport, Carlsbad, CA (elevation 320 feet). A total of 15 flights were conducted during 21.8 hours (17.4 hours productive). The objectives of the test were to reevaluate certain flight characteristics which were undesirable during Phase 1 testing, and to assess the effect of design changes on aircraft handling qualities. This phase of the aircraft development was not intended to address all of the undesirable flight characteristics uncovered during the Phase 1 testing. Many enhancing characteristics, deficiencies, and shortcomings, reported during the government competitive test (GCT) remain valid. The YAH-64 continues to have the potential to be developed into an excellent attack helicopter.
GRA

N79-22078# Effects Technology, Inc., Santa Barbara, Calif.
DYNAMIC BEHAVIOR OF AIRCRAFT MATERIALS Final Report, 15 Feb. - 31 Dec. 1977
Frederic A. Bick and Pamela VanBlaricum 28 Feb. 1978 129 p refs
(Contract DNA001-77-C-0103)
(AD-A064592; AD-E300446; ETI-CR-78-485; DNA-4545F) Avail: NTIS HC A07/MF A01 CSCL 01/3

Dynamic, high strain rate loading characterization of two composite materials that are being used today in the design of military and commercial aircraft was accomplished. Of particular concern was the response of such materials to nuclear blast and thermal environments. Primary emphasis is placed on the graphite epoxy designated AS/3501-6, as would be used in body or wing panels. Of secondary emphasis is the quartz polyimide designated F178/581, a radome material. Both materials were tested quasistatically and dynamically (strain rates up to 18 inches/in/sec), and from -65F to above resin cure temperature (Cure temperatures of 350F for the graphite epoxy and 475F for the quartz polyimide). Test results indicated that both materials were stronger under dynamic loads than quasistatic loads. Additionally, at elevated temperatures the responses were dramatically different with the dynamic properties exhibiting little or no degradation due to temperature effects, while quasistatic properties decreased significantly with temperature.
Author (GRA)

N79-22079# Ballistic Research Labs., Aberdeen Proving Ground, Md.
HIGHLY SURVIVABLE TRUSS TAIL BOOM
Thomas F. Erline Nov. 1978 175 p refs
(AD-A064181; AD-E430172; ARBRL-TR-02123) Avail: NTIS HC A08/MF A01 CSCL 01/3

Highly redundant truss type structures, which are lightweight, have been analyzed by NASTRAN for replacement of the semimonocoque type tail boom. Analyses show that even with massive damage criterion imposed, the structure retains its integrity with level flight loads up to 130 knots. The truss presents itself as a structural challenge to Soviet AA threat of the 23mm and 30mm HEI rounds. Comparing the vulnerable semimonocoque configuration with the truss structure: semimonocoque's vulnerable area is nearly 100% of the present area; the truss has a greatly reduced vulnerable area (the joints are most vulnerable and their areas are small). The semimonocoque is blast sensitive to the AA threats mentioned because the detonation is confined and a large surface area is blown away; the truss does not confine the blast, thus is less sensitive. Since the thin skin structure of the semimonocoque carries a great deal of load it is sensitive to crack propagation; the truss is insensitive to crack propagation. Since the truss can be easily designed lightweight, the truss presents itself as a highly survivable competitive alternate for future Army helicopters. Author (GRA)

N79-22080# Kaman Aircraft Corp., Bloomfield, Conn.
PRELIMINARY DESIGN STUDY OF A COMPOSITE MAIN ROTOR BLADE FOR THE OH-58 HELICOPTER. VOLUME 1: TRADE ANALYSIS AND PRELIMINARY DESIGN STUDY OF COMPOSITE OH-58 MAIN ROTOR BLADE Final Report, Oct. 1977 - Feb. 1978
Charles Hardersen and William Blackburn Sep. 1978 212 p refs
(Contract DAAJ02-77-C-0075; DA Proj. 1L2-62209-AH-76)
(AD-A064159; R-1532-Vol-1; USARTL-TR-78-29A) Avail: NTIS HC A10/MF A01 CSCL 01/3

The objective of this program was to design a composite rotor blade for the OH-58C/A helicopter which has reduced life-cycle costs, 6% improved hover performance, improved reliability and maintainability, reduced radar signature and increased ballistic survivability. A trade-study approach was used to select the final configuration for the preliminary design phase. A monolithic composite structure evolved which utilizes winding in the production of the main spar, skins and the trailing edge spline. The blade satisfies basic objectives using a double-tapered planform and a VR-7 airfoil. Composite materials selected include S-glass, E-glass and carbon graphite.
GRA

N79-22081# Army Research and Technology Labs., Fort Eustis, Va.
CH-47 HELICOPTER INTERNAL CARGO LOAD AND RESTRAINT SYSTEM MOCK-UP STUDY Technical Note, Aug. 1977 - Nov. 1978
John F. Tansey Nov. 1978 17 p
(AD-A064207; USARTL-TN-32) Avail: NTIS HC A02/MF A01 CSCL 01/3

A conceptual CH-47 helicopter internal cargo load and restraint system was designed, and a nonflightworthy functional mock-up of the system was constructed. Mock-up components consisted of a rail/roller and support grid, fore-and-aft cargo barriers, and a ball transfer table. The system was tested in a CH-47 and proved to be easily installed without aircraft modification. Ease of use with standard Army warehouse pallets and USAF 463 pallets was demonstrated. It was concluded that the system has potential for maximizing aircraft payload capabilities and improving cargo handling procedures significantly. The same technology could also be made applicable to utility helicopters.
Author (GRA)

N79-22082# Computer Sciences Corp., Silver Spring, Md. System Sciences Div.
THE PREDESIGN PHASE OF THE SECOND-GENERATION COMPREHENSIVE HELICOPTER ANALYSIS SYSTEM Final Report, 8 Sep. 1977 - 22 May 1978
Oct. 1978 396 p refs Prepared for Army Res. and Technol. Labs.
(Contract DAAJ02-77-C-0057; DA Proj. 1L2-63211-D-157)
(AD-A063921; USARTL-TR-78-41) Avail: NTIS HC A17/MF A01 CSCL 01/3

This report summarizes the results of the Predesign Phase work for the Second-Generation Comprehensive Helicopter Analysis System. The report includes an executive summary, summarizes a conceptual design for the System, describes the System's capability provided in the First Level Release and Second

Level Release, discusses how the System would be used, presents a summary of the plans for development of the System, and presents discussions of risk considerations. The objectives and life cycle of the System are presented in terms of the six life-cycle phases: planning, predesign, development, validation, maintenance, and user applications. Predesign Phase objectives and results are discussed. An overview of the System design is provided for the engineering manager, the engineering user, and the programmer. Four major design characteristics that the System must possess for it to be universally accepted by the helicopter analysis community are discussed: user orientation, efficiency, transportability, and extendability. The mathematical basis for the System is presented in terms of the types of problems to be solved by the System, the finite element approach, the coupling of components, aerodynamic effects, and numerical analysis considerations. The System's software architecture is presented hierarchically. GRA

N79-22083# Control Data Corp., Hampton, Va.
PREDESIGN OF THE SECOND-GENERATION COMPREHENSIVE HELICOPTER ANALYSIS SYSTEM Final Report
Oct. 1978 162 p refs
(Contract DAAJ02-77-C-0058; DA Proj. 1L2-63211-D-157)
(AD-A064131; USARTL-TR-78-43) Avail: NTIS HC A08/MF A01 CSCL 01/3

This report summarizes the efforts and results of the predesign of the Second-Generation Comprehensive Helicopter Analysis System (also referred to as the System). Attention is focused on the solution to problems that are inherent in the design, development, maintenance, validation, and use of a system that satisfies the objectives and requirements set forth in the Statement of Work. The objectives and design considerations are presented, along with a comprehensive design that will enable the realization of all objectives through the use of dynamic component coupling techniques, a comprehensive but simple user-oriented control language, and an extensive library of technical modules. System usage has been described in three levels: Basic, Intermediate, and Advanced. Suggested responsibilities and relationships of the various agencies during the Development Phase are presented; also development schedules, documentation, and testing requirements are included. The concept of a Baseline Review Board and its activities are offered to enhance quality assurance control. Based on the results of the Predesign Phase, the Second-Generation Comprehensive Helicopter Analysis System has been determined by Control Data Corporation and Kaman Aerospace Corporation to be a feasible system that will provide users with a viable vehicle for current and future endeavors in the prediction of performance, stability and control, acoustics, loads, and aeroelastic stability characteristics of rotorcraft.
Author (GRA)

N79-22084# Science Applications, Inc., McLean, Va.
PREDESIGN OF THE SECOND GENERATION COMPREHENSIVE HELICOPTER ANALYSIS SYSTEM Final Report, Sep. 1977 - May 1978
T. Hamrick, D. Copeland, F. Tarzanin, J. Staley, L. Hunt, and G. Burns Dec. 1978 149 p refs
(Contract DAAJ02-77-C-0059; DA Proj. 1L2-63211-D-157)
(AD-A064289; USARTL-TR-78-42) Avail: NTIS HC A07/MF A01 CSCL 01/3

A predesign study was conducted for a proposed Second Generation Comprehensive Helicopter Analysis System (CHAS). A draft Type A system specification was reviewed to determine its validity for a system to analyze helicopter performance, stability and control, loads, aeroelastic stability, and acoustics using consistent technology with a capability for several levels of complexity. GRA

N79-22085# Boeing Vertol Co., Philadelphia, Pa.
OH-58 COMPOSITE MAIN ROTOR BLADES PRELIMINARY DESIGN INVESTIGATION Final Report
J. S. Hoffrichter Nov. 1978 240 p refs
(Contract DAAJ02-77-C-0074; DA Proj. 1L2-62209-AH-76)
(AD-A065010; USARTL-TR-78-27) Avail: NTIS HC A11/MF A01 CSCL 01/3

This report presents the results of a design study to replace the existing OH-58 C/A Main Rotor Blade with a Composite Rotor Blade. The effort consisted of a trade study phase and a preliminary design phase. The composite construction rotor blade defined in this report in whole or in part meets the defined improvement objectives in the areas of life cycle cost, performance, reliability and maintainability, radar reflectivity, and ballistic survivability. GRA

N79-21998# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
HIGH ANGLE OF ATTACK CHARACTERISTICS OF DIFFERENT FIGHTER CONFIGURATIONS
H. John and W. Kraus *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 15 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-21999# Royal Aircraft Establishment, Farnborough (England).
SOME UK RESEARCH STUDIES OF THE USE OF WING-BODY STRAKES ON COMBAT AIRCRAFT CONFIGURATIONS AT HIGH ANGLES OF ATTACK
G. F. Moss *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 19 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22000*# General Dynamics/Fort Worth, Tex.
DESIGN GUIDELINES FOR THE APPLICATION OF FOREBODY AND NOSE STRAKES TO A FIGHTER AIRCRAFT BASED ON F-16 WIND TUNNEL TESTING EXPERIMENT
C. W. Smith and C. A. Anderson *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 11 p refs (For primary document see N79-21996 13-01)
(Contract NAS1-15006)
Avail: NTIS HC A23/MF A01 CSCL 01C

N79-22004# Lockheed-Georgia Co., Marietta. Flight Sciences Div.
THE APPLICATION OF SPANWISE BLOWING FOR HIGH ANGLE OF ATTACK SPIN RECOVERY
J. J. Cornish, III and M. W. M. Jenkins *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 12 p (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22005# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
BEHAVIOR OF A TRANSPORT AIRCRAFT WITH A HIGH ASPECT RATIO WING AT A HIGH ANGLE OF INCIDENCE [COMPORTEMENT A HAUTE INCIDENCE U'UN AVION DE TRANSPORT A AILE A GRAND ELANCEMENT]
D. Collard *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 12 p In FRENCH (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22022# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
NORMAL FORCE AND PITCHING MOMENT OF WING-BODY COMBINATIONS IN THE NONLINEAR ANGLE-OF-ATTACK RANGE AT SUBSONIC SPEEDS
C. P. Schneider and D. Nikolitsch *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

N79-22026*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH ANGLE OF INCIDENCE IMPLICATIONS UPON AIR INTAKE DESIGN AND LOCATION FOR SUPERSONIC CRUISE AIRCRAFT AND HIGHLY MANEUVERABLE TRANSONIC AIRCRAFT
Leroy L. Presley *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 10 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N79-22027# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Military Airplane Div.
INTAKE DESIGN AND INTAKE/AIRFRAME INTEGRATION

FOR A POST-STALL FIGHTER AIRCRAFT CONCEPT
K. W. Lotter and J. Malefakis *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 16 p refs (For primary document see N79-21996 13-01)
Avail: NTIS HC A23/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-22086# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PARAMETRIC ANALYSIS OF STEREOMETRIC TRACKER FOR USE IN TACTICAL AIRCRAFT M.S. Thesis
Kurt F. Schroeder Oct. 1978 115 p refs
(AD-A064688; AFIT/GEP/PH/78D-11) Avail: NTIS HC A06/MF A01 CSCL 17/8

The stereometric range finding technique is used as the basis of an airborne passive tracker. An analysis of the method reveals that angular accuracy is the most critical element in this technique. Range accuracy can be improved by increasing baseline separation. However, the vibration environment of the aircraft becomes worse as the baseline is increased. The results of this investigation indicate that these vibrations counter any gain in resolution. The investigation was hindered by a lack of vibrational data, especially angular vibration data. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-22087*# Pennsylvania State Univ., State College. Applied Research Lab.
THE EFFECTS OF DESIGN AND OPERATING VARIABLES ON THE RESPONSE OF AN AXIAL FLOW FAN TO INLET FLOW DISTORTIONS M.S. Thesis
Adam M. Yocum, II 14 Jun. 1978 228 p refs
(Grant NsG-3031; Contract N00017-73-C-1418)
(NASA-CR-158522; ARL/TM-78-178) Avail: NTIS HC A11/MF A01 CSCL 21E

The results of a study of total pressure and velocity circumferential distortions in an axial-flow fan are presented. Some of the fundamental experimental data needed to understand distorted flow phenomena as affected by design and operating variables are provided. The flow through an isolated rotor was examined at various operating conditions with six different distortions and three different blade stagger angles. Circumferential surveys were conducted upstream and downstream of the rotor using five-hole probes in the nonnulling mode. The total pressure and axial velocity distortion data were analyzed to determine the degree of distortion attenuation as a function of blade stagger angle, mean incidence angle, and reduced frequency. The results indicate that, for the rotors tested, the mean incidence or loading has very little effect on the distortion attenuation. G.Y.

N79-22088# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
VKI SHORT COURSE ON FLOW IN TURBINES
Apr. 1969 302 p refs Course held at Rhode-Saint-Genese, Belgium, 14-18 Apr. 1969
(VKI-Lecture-Series-15) Avail: NTIS HC A14/MF A01

Problems associated with gas turbine blade geometry and cooling are examined. Methods are given for analyzing cascade flow and flows in stators and rotors. For individual titles, see N79-22089 through N79-22092.

N79-22089# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE FLOW THROUGH LOW CAMBERED TRANSONIC TURBINE CASCADE
C. H. Sieverding and R. Sampson *In its* VKI Short Course on Flow in Turbines Apr. 1969 40 p refs (For primary document see N79-22088 13-07)
Avail: NTIS HC A14/MF A01

The flow in low cambered transonic cascades with a well defined geometric throat can be reasonably well by theory. The flow properties in the throat region of cascades without defined geometric throats however, must be determined by experimental investigations. When the cascade flow is known, the losses can be calculated for the following idealized conditions: (1) no shock-boundary layer interaction; (2) no boundary layer separation near the trailing edge; and (3) trailing edge of negligible thickness. A proper loss calculation including these effects does not yet seem to exist. Flow problems in transonic turbine blading are discussed for three blade configurations. The cascade flow is calculated in the subsonic flow field, during the transition from subsonic to supersonic flow field, and for the supersonic flow field downstream of the throat. Experimental and theoretical results are compared. Reattachment and separation criteria are given as well as procedures for calculating the confluence of two supersonic jet boundaries behind the trailing edge of a blade. A.R.H.

N79-22090# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO COOLING OF GAS TURBINE BLADES
C. Liess *In its* VKI Short Course on Flow in Turbines Apr. 1969 105 p refs (For primary document see N79-22088 13-07)
Avail: NTIS HC A14/MF A01

The development of heat resistant alloys and the use of various methods for cooling turbine blades and vanes to improve the gain in turbine entry temperature are reviewed. The influence of turbine design and engine components on cooling problem is assessed and methods are given for calculating cooled blades. The thermal and aerodynamic losses resulting from blade cooling are discussed as well as fabrication costs for cooled blades. Requirements on a cooling system are described. The advantages and disadvantages of internal and external liquid or air cooling are examined as well as those for a combined internal and external air cooling system. A.R.H.

N79-22091# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMIC PROBLEMS IN COOLED TURBINE BLADING DESIGN FOR SMALL GAS TURBINE
J. Chauvin, K. Papailiou, and L. Burrows *In its* VKI Short Course on Flow in Turbines Apr. 1969 32 p refs Presented at the 32d Meeting of AGARD Propulsion and Energetics Panel on Advanced Components for Turbojet Engines, Toulouse, 9-13 Sep. 1968 (For primary document see N79-22088 13-07)
Avail: NTIS HC A14/MF A01

The next generation of small gas turbines (in the 500-1000 shp range) will have to use turbine inlet temperatures of the order of 1300 C, if specific fuel consumption and specific power better than those of piston engines must be reached. Such temperature can be realized only if cooling of the nozzle and blades of the compressor turbine is used. Air and liquid cooling are being considered. Strength and space requirement lead to the use of thick blades, especially at the trailing edge, and having a minimum chord length of several centimeters. The mass flow to handle leads to small passages height and therefore to aspect ratios of the order of 0.4. High losses are generated due to blade profile, trailing edge thickness and above all, secondary losses. The VKI turbomachinery laboratory research in the field of blade optimization and in the analysis and reduction of secondary flows and losses is reviewed. Author

N79-22092# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

AXIAL FLOW TURBINES
H. Vavra *In its* VKI Short Course on Flow in Turbines Apr. 1969 92 p refs (For primary document see N79-22088 13-07)
Avail: NTIS HC A14/MF A01

Topics covered include: fundamental flow relations (equations of motion energy, and continuity); axisymmetric orthogonal coordinate systems; three dimensional flows; flow in turbine cascades; geometry of blade profiles; losses in turbine stages; and off-design performance. A.R.H.

N79-22093# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
CLOSED CYCLE GAS TURBINES
1970 347 p refs Lecture held at Rhode-Saint-Genese, Belgium, 11-15 May 1970
(VKI-Lecture-Series-24) Avail: NTIS HC A15/MF A01

The requirements of closed cycle gas turbines are discussed as well as the thermophysical properties of various working fluids. Methods for calculating thermodynamic efficiency and for component design are described. For individual titles, see N79-22094 through N79-22098.

N79-22094# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
CLOSED POWER CYCLES' ANALYSIS
Gianfranco Angelino *In its* Closed Cycle Gas Turbines 1970 93 p refs (For primary document see N79-22093 13-07)
Avail: NTIS HC A15/MF A01

The general configuration and basic requirements of closed power cycles are discussed with emphasis on the mean density of the working fluid. Methods are given for computing the thermodynamic properties of various working fluids from their volumetric behavior as well as through the principle of corresponding states. Topics covered include: analysis of Rankine cycles; entrophy analysis; organic fluid Rankine cycles; single phase gas cycles (both real and ideal); nonconventional closed power cycles and configurations; and carbon dioxide nonconventional closed power cycles. Tables show the thermophysical properties of sodium, potassium, rubidium, cesium, mercury, water, carbon dioxide, sulfur, hexafluoride, perfluoropropane, dichlorodifluoromethane, perfluorocyclobutane, and perfluorobenzene.A.R.H.

N79-22095# Technische Universitaet, Hanover (West Germany).
DYNAMIC BEHAVIOUR AND CONTROL OF SINGLE-SHAFT CLOSED-CYCLE GAS TURBINES
K. Bammert and G. Krey *In* Von Karman Inst. for Fluid Dyn. Closed Cycle Gas Turbines 1970 28 p refs (For primary document see N79-22093 13-07)
Avail: NTIS HC A15/MF A01

Although a precise calculation of the dynamic behavior of a closed-cycle gas turbine involves great mathematical display, sufficiently exact results can be achieved by reasonably simplifying the most difficult problems. Corresponding precalculations carried out on a digital computer quickly render possible the selection of the most suitable control principle, the layout of the regulating apparatuses such as valves, controllers, and the starting motor. Such calculations also permit the optimization of the controller adjustment and the determination of stability limits of the control loop. The exact solution of these points is of importance not only in regard to an undisturbed operation of the power plant, but also in view of safety, particularly in the case of a nuclear helium turbine. Author

N79-22096# AiResearch Mfg. Co., Phoenix, Ariz.
CLOSED BRAYTON CYCLE SYSTEM OPTIMIZATION FOR UNDERSEA, TERRESTRIAL, AND SPACE APPLICATIONS
Edward A. Mock *In* Von Karman Inst. for Fluid Dyn. Closed Cycle Gas Turbines 1970 97 p refs (For primary document see N79-22093 13-07)
Avail: NTIS HC A15/MF A01

Considerable flexibility is available when adapting the closed Brayton cycle to a particular application and this same flexibility is required in the analysis procedures. These procedures must accurately predict the system performance since critical design decisions are frequently based on the results. Accordingly, the Brayton cycle system analysis procedures are discussed to show the basis and depth of the analysis. Detailed optimization studies of two cycles for the same undersea application are presented and the selection of the reference system discussed. Optimization study results of several other system applications and existing hardware descriptions are included. Of particular note are the results of the system studies directed toward defining the power system for the future NASA space station space base. Author

N79-22097*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN PROBLEMS OF SMALL TURBOMACHINERY
H. E. Rohlik *In* Von Karman Inst. for Fluid Dyn. Closed Cycle Gas Turbines 1970 11 p refs (For primary document see N79-22093 13-07)
Avail: NTIS HC A15/MF A01 CSCL 21E

Advanced design and testing techniques developed at NASA Lewis to achieve high efficiency in small turbomachines are described. Small radial and axial turbines and compressors were built for space power systems and associated studies at the Lewis Research Center. A six stage axial compressor of 3.5 inches diameter and axial turbines of 5 and 8.5 inches diameter were included. Radial turbines and compressors ranged from 3.5 to 6 inches. Topics discussed include maximum efficiency as a function of speed, the effect of compressibility on passage size, the use of quasi-orthogonals to calculate cross-channel velocity gradients, a design point velocity diagram study for axial turbines, and estimating off-design performance. Special turbine instruments and calibration procedures were developed to test compressors and turbines, to determine Reynolds and size number effects clearance, specific speed effects, and compressor performance. Laboratory tests conducted to study system operation and shaft and bearing motions are also reviewed. A.R.H.

N79-22098# Gutehoffnungshuette Sterkrade A. G., Oberhausen (West Germany).
CALCULATION AND DESIGN OF CLOSED CYCLE HELIUM TURBINES FOR HIGH TEMPERATURE REACTORS
W. Twardziok *In* Von Karman Inst. for Fluid Dyn. Closed Cycle Gas Turbines 1970 10 p refs (For primary document see N79-22093 13-07)
Avail: NTIS HC A15/MF A01

The coupling of closed cycle gas turbines with helium cooled high temperature reactors is discussed with emphasis on thermodynamics, the layout of helium turbines for high output, and general plant arrangement. Topics covered include cycle arrangements, influence of gas properties, calculating the overall circuit, and the determination of mass flow, conditions of state, and internal efficiencies. From these parameters, the turbines, compressors, and turbosets can be designed. Projected development activities include the construction of test rigs and a test program for hot-gas valves and insulations. A.R.H.

N79-22099*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A VORTEX-CONTROLLED DIFFUSER IN AN ANNULAR SWIRL-CAN COMBUSTOR AT INLET MACH NUMBERS UP TO 0.53
John M. Smith Washington Apr. 1979 17 p refs
(NASA-TP-1452; E-9832) Avail: NTIS HC A02/MF A01 CSCL 21E

A short, annular dump diffuser with suction stabilized vortices in the region of abrupt area change was tested with a full scale, annular swirl can combustor. The prediffuser area ratio was 1.4. Performance data were obtained for both isothermal and burning conditions at inlet temperatures of 589 to 895 K and pressures of 0.5 to 1.0 MPa for a range of diffuser inlet Mach numbers from 0.25 to 0.53. Suction rates were 0 to 20 percent of the total diffuser mass flow rate. Diffuser effectiveness increased from 47 percent without suction to approximately 80 percent for a total suction rate of 14 percent. Combustor total pressure loss for the same total suction rate was reduced from 6.8 percent without suction to 4.0 percent at an inlet Mach number of 0.40. Author

N79-22100*# Flow Research, Inc., Kent, Wash.
PROCEDURE FOR NOISE PREDICTION AND OPTIMIZATION OF ADVANCED TECHNOLOGY PROPELLERS Final Report
Wen-Huei Jou and Samuel Bernstein Apr. 1979 54 p refs
(Contract NAS2-9807)

(NASA-CR-3080; Rept-119) Avail: NTIS HC A04/MF A01 CSCL 01C

The sound field due to a propeller operating at supersonic tip speed in a uniform flow was investigated. Using the fact that the wave front in a uniform stream is a convected sphere, the fundamental solution to the convected wave equation was easily obtained. The Fourier coefficients of the pressure signature were obtained by a far field approximation, and are expressed as an integral over the blade platform. It is shown that cones of silence exist fore and aft the propeller plane. The semiapex angles are shown. These angles are independent of the individual Mach components such as the flight Mach number and the rotation Mach number. The result is confirmed by the computation of the ray path of the emitted Mach waves. The Doppler amplification factor strengthens the signal behind the propeller while it weakens that upstream. J.M.S.

N79-22101*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PERFORMANCE ESTIMATION FOR A HIGHLY LOADED EIGHT-BLADE PROPELLER COMBINED WITH AN ADVANCED TECHNOLOGY TURBOSHAFT ENGINE

Shelby J. Morris, Jr. Apr. 1979 49 p refs

(NASA-TM-80075) Avail: NTIS HC A03/MF A01 CSCL 21A

Performance estimation, weights, and scaling laws for an eight-blade highly loaded propeller combined with an advanced turboshaft engine are presented. The data are useful for planned aircraft mission studies using the turboprop propulsion system. Comparisons are made between the performance of the 1990+ technology turboprop propulsion system and the performance of both a current technology turbofan and an 1990+ technology turbofan. Author

N79-22102# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

DESIGN, FABRICATION, AND EVALUATION OF GATORIZED (TRADE NAME) CERAMIC-WROUGHT ALLOY ATTACHMENT CONCEPTS Final Report, 1 Jul. 1974 - 31 Jul. 1978

S. A. McLeod and B. H. Walker Jan. 1979 118 p refs

(Contract N00019-74-C-0484)

(AD-A064597; FR-9787) Avail: NTIS HC A06/MF A01 CSCL 21/5

The attachment of hot pressed silicon nitride material (HPSN) ceramic blades to a wrought superalloy disk, utilizing the GATORIZING forging process, was developed and demonstrated for application in small gas turbine engines. The development of this hybrid attachment concept consisted of fabricating, optimizing, and evaluating single ceramic blade/wrought alloy attachments by spin testing at ambient and elevated temperatures. The hybrid rotor concept was demonstrated by designing, fabricating, and spin testing several fully-bladed hybrid rotors, some containing ceramic simulated pseudoblades and others containing airfoil blades. The spin testing was conducted at speeds and temperatures comparable to small gas turbine engines. Author (GRA)

N79-22103# United Technologies Research Center, East Hartford, Conn.

NONLINEAR STOCHASTIC CONTROL DESIGN FOR GAS TURBINE ENGINES Final Technical Report, 1 Apr. 1976 - 31 Mar. 1978

Florence A. Farrar and Gerald J. Michael Jun. 1978 54 p refs

(Contract N00014-76-C-0710; RR0141184)

(AD-A065075; UTRC/R78-942577-13; ONR-CR-215-247-2F) Avail: NTIS HC A04/MF A01 CSCL 21/5

Synthesis procedures for nonlinear stochastic feedback control of gas turbine engines were developed and evaluated. Modern estimation and control procedures based upon separating the stochastic and deterministic aspects of the control problem were employed. The resulting closed-loop control consists of nonlinear deterministic feedback control logic designed using piecewise-linear/piecewise-optimal techniques, and an estimator designed using nonlinear filtering logic. Engine variables estimated from noise-corrupted measurements are fed back through the deterministic control logic to generate commanded inputs to the engine. Mode-switching logic was developed to provide smooth transition between small-signal regulation and large-signal transient modes of estimator/controller operation. GRA

N79-22104# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

LO-FREQUENCY AUGMENTOR INSTABILITY STUDY Final Report, 1 Mar. 1976 - 30 Jul. 1978

P. Z. Russell and G. Brant 15 Dec. 1978 230 p refs

(Contract F33615-76-C-2024)

(AD-A065144; PWA-FR-10397; AFAPL-TR-78-82) Avail: NTIS HC A11/MF A01 CSCL 21/5

With the advent of the mixed-flow afterburner in turbofan engines, a type of low-frequency instability known as rumble became a serious problem. Rumble occurs mainly at high fuel-air ratios and at flight Mach numbers and altitudes where low duct inlet air temperatures and pressures exist. 'Cut and try' methods of solution during engine development have been partially successful, but very expensive. To aid the development engineer in designing rumble-free afterburners an analytical model has been formed. The model was evolved in conjunction with and checked by two experimental programs. Rumble mechanisms investigated early in this study involved system airflow dynamics, combustion efficiency oscillations, fuel vaporization and recirculation wake energy. The model was then refined and extended to include the mixed flow experienced in a turbofan augmentor. Predictions were made for the effects of altitude, fan stream fuel-air ratio, fan stream temperature, core stream fuel-air ratio, and fan duct pressure loss. The major conclusion from the modeling effort was that the efficiency falloff in the fan stream at high fuel-air ratio causes rumble. This was verified with engine altitude tests at NASA Lewis Research Center with several augmentor configurations. These tests included heat addition to the fan stream, fuel-air distribution changes and spraybar to flameholder length variation. The basic formulation of the model, the mixed flow augmentor model, predictions, and the experimental programs are discussed. Author (GRA)

N79-22105# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

ADVANCED COMPOSITE ENGINE ROTOR DESIGN Final Technical Report, Oct. 1977 - Mar. 1978

Richard Ravenhall, Robert Strabrylla, and Lewis Stoffer Oct. 1978 117 p

(Contract F33615-77-C-5201)

(AD-A063843; R78AEG333; AFML-TR-78-134) Avail: NTIS HC A06/MF A01 CSCL 21/5

This report describes the results of an advanced composite-rotor mechanical-design-feasibility study program. Four advanced composite fan-rotor concepts and one composite reinforced compressor-rotor concept were evolved and evaluated during this study. One particular fan concept, titled 'pinned-blade/hoop rotor,' received extended evaluation because it allowed the replacement of blades and showed a significant weight and cost advantage over the metal counterpart. This concept was applied to both a subsonic-flight engine and a supersonic-flight engine for potential future development. Author (GRA)

N79-22106# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

REGRESSION SIMULATION OF TURBINE ENGINE PERFORMANCE/AIRCRAFT REGRESSION MODEL Final Technical Report, Sep. 1977 - Jul. 1978

Warren Joy and Donald E. Uehling Nov. 1978 76 p refs

(Contract F33615-77-C-2108; AF Proj. 3066)

(AD-A063975; R78AEG445; AFAPL-TR-78-76) Avail: NTIS HC A05/MF A01 CSCL 21/5

The Aircraft Regression Model (ARM) Task has explored modification of the Boeing Turbine Engine Variable Cycle Selection/Airplane Response Engine Selection(TEVCS/ARES) procedures by decoupling the representation of specific propulsion systems and the detailed mission definitions from the overall surface fit representations of the aircraft. Detailed comparisons between the RSTEP/ARM techniques developed herein and another available technique for aircraft/engine design refinement are provided as the principal result of this program. All objectives of the RSTEP/ARM effort were attained. A simplified mission performance computer program was developed and tested in the evaluation of two engine cycle concepts, one a turbojet and

one a turbofan. The program was simplified by using regression models for airframe geometry, weights, and drags. The program is currently operational in both the Air Force and at two industry sites. GRA

N79-22107# AiResearch Mfg. Co., Phoenix, Ariz.
RESEARCH AND EVALUATION PROGRAM ON A BACKUP CONTROL SYSTEM FOR GAS TURBINE ENGINES Final Report, Oct. 1977 - Aug. 1978
Trevor G. Sutton Sep. 1978 38 p refs
(Contract DAAG39-77-C-0186)
(AD-A064326; AiResearch-41-2111; HDL-CR-78-186-1) Avail: NTIS HC A03/MF A01 CSCL 21/5

This report presents the results of a program conducted by AiResearch and funded by Harry Diamond Laboratories to investigate backup control systems for gas turbine engines which could be used in military ground vehicles. The program addressed the control system requirements that are deemed necessary to provide a military gas turbine powered vehicle with battlefield survivability and minimal restriction on the capability of completing the vehicle mission. This study showed that a parallel dissimilar technology backup control was the desirable approach and that fluidics was the ideal technology to perform this function due to its low cost, realiability, immunity to radiation, and ability to perform computation and logic commensurate with the requirements of achieving mission completion with no degradation in the vehicle's battlefield survivability. Author (GRA)

N79-22108# Panametrics, Inc., Waltham, Mass.
ADVANCED TECHNOLOGY FUEL MASS FLOWMETER Final Report, Jun. 1977 - Jun. 1978
Lawrence C. Lynnworth, Norman E. Pedersen, John L. Seger, and James E. Bradshaw Oct. 1978 53 p refs
(Contract DAAJ02-76-C-0030)
(AD-A063963; USARTL-TR-78-45; Rept-138) Avail: NTIS HC A04/MF A01 CSCL 21/4

The fuel mass flowmeter system demonstrated in a previous Army program, consisting of an ultrasonic flow velocimeter and a capacitance-type densitometer, was adapted to T-700 gas turbine engine requirements. Mechanical adaptations included the reduction in size and weight of the flow cell to fit the configuration and mounting constraints of a T-700 engine. Electronic developments included repackaging into a portable field-type case, configuration switching and digital delay equalizers, and the substitution of a microprocessor for a previously used calculator chip, resulting in a choice of response times, or integration times, selectable from approximately 50s down to approximately 0.5s. GRA

N79-22109*# Scott Environmental Technology, Inc., Plumsteadville, Pa.
F-100 TURBINE ENGINE AFTERBURNER EMISSION TESTS Final Report, Nov. 1976 - Dec. 1977
Anthony F. Sousa and Harold A. Scott, Jr. Sep. 1978 90 p refs
(Contract F08635-77-C-0216; AF Proj. 2103)
(AD-A063789; SET-1628-01-1177; CEEDO-TR-78-54) Avail: NTIS HC A05/MF A01 CSCL 21/2

The afterburner exhaust emissions from three F-100-P-100 engines were measured. Emission rates of hydrocarbons, carbon monoxide and oxides of nitrogen were calculated. Smoke numbers were also measured. Author (GRA)

N79-22110# Teledyne Ryan Aeronautical Co., San Diego, Calif.
RPV ELECTRIC POWER SYSTEM STUDY. PHASE 2: HOT BENCH MOCKUP DEVELOPMENT Final Technical Report, 1 May 1978 - 31 Aug. 1978
Frederic L. Miller and Lou Pico Nov. 1978 100 p
(Contract F33615-76-C-2069; AF Proj. 3145)
(AD-A065008; TRA-29318-08; AFAPL-TR-78-93) Avail: NTIS HC A05/MF A01 CSCL 01/3

The RPV Electric Power Study explores ways for exploiting technology and resolving critical issues affecting the electrical subsystems of remotely piloted vehicles. The objective is to define electrical components and system concepts that offer significant cost, weight and performance improvements over present day systems. Phase I is an assessment of technologies capable of benefitting RPV electrical systems. Phase II develops a plan to transfer viable technologies into RPV systems. The Phase II approach is to first develop a complete picture of the needs, requirements and constraints on a laboratory hot bench mockup. After considering concept alternatives and related design factors, a modular concept is selected that is adaptable to all classes of RPV. Preliminary designs of a mockup for each of the four classes of RPV are described, that is; Advanced multi-mission RPV, High-altitude long endurance RPV, Mini RPV, and Tactical expendable drone system (TEDS). A mockup development plan is presented for each RPV class including a schedule, budgetary estimate of labor and material costs, list of components and a list of manufacturers capable of developing those items requiring development. Also included is a guide for developing test programs for RPV electrical systems. Author (GRA)

N79-22111# National Technical Information Service, Springfield, Va.
TURBINE BLADES: EROSION AND CORROSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1979
Guy E. Habercom, Jr. Mar. 1979 171 p Supersedes NTIS/PS-78/0144; NTIS/PS-77/0086; NTIS/PS-76/0081; NTIS/PS-75/127
(NTIS/PS-79/0148/1; NTIS/PS-78/0144; NTIS/PS-77/0086; NTIS/PS-76/0081; NTIS/PS-75/127) Avail: NTIS HC $28.00/MF $28.00 CSCL 21E

These Government-sponsored research reports describe sources of erosion/corrosion of turbine blades and suggest methods to eliminate or alleviate the problems. This updated bibliography contains 165 abstracts, 26 of which are new entries to the previous edition. GRA

N79-22112# National Technical Information Service, Springfield, Va.
TURBINE BLADES: EROSION AND CORROSION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1979
Guy E. Habercom, Jr. Mar. 1979 201 p Supersedes NTIS/PS-78/0145; NTIS/PS-77/0087; NTIS/PS-76/0082
(NTIS/PS-79/0149/9; NTIS/PS-78/0145; NTIS/PS-77/0087; NTIS/PS-76/0082) Avail: NTIS HC $28.00/MF $28.00 CSCL 21E

These reports, gathered in a worldwide literature survey, describe sources of erosion/corrosion of turbine blades and suggest methods to eliminate or alleviate the problems. This updated bibliography contains 195 abstracts, 36 of which are new entries to the previous edition. GRA

N79-22128# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Applied Aerodynamics Div.
HYPERSONIC VEHICLES PROPULSION AERODYNAMIC PROBLEMS
R. Ceresuela *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 32 p refs (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-22113*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
IMPORTANT FACTORS IN THE MAXIMUM LIKELIHOOD ANALYSIS OF FLIGHT TEST MANEUVERS
Kenneth W. Iliff, Richard E. Maine, and T. D. Montgomery Apr. 1979 44 p refs
(NASA-TP-1459; H-1076) Avail: NTIS HC A03/MF A01 CSCL 01C

The information presented is based on the experience in the past 12 years at the NASA Dryden Flight Research Center of estimating stability and control derivatives from over 3500 maneuvers from 32 aircraft. The overall approach to the analysis

of dynamic flight test data is outlined. General requirements for data and instrumentation are discussed and several examples of the types of problems that may be encountered are presented.
S.E.S.

N79-22114# Bendix Corp., Teterboro, N. J. Flight Systems Div.
ADVANCED FLIGHT CONTROL ACTUATION SYSTEM (AFCAS-E/P): FEASIBILITY INVESTIGATION OF AN ELECTRO/PNEUMATIC DUAL POWER DRIVEN CONCEPT Final Report, Mar. 1977 - May 1978
R. E. Feucht, Rex W. Presley, Philip Forman, and Richard Krehely Jun. 1978 121 p
(Contract N62269-77-C-0171)
(AD-A063992; FSD-7411-78-05; NADC-77001-60) Avail: NTIS HC A06/MF A01 CSCL 01/3

This is a report of design study on Dual-Mode Dynavector Actuator for use as control-surface actuator on aircraft. Actuator operates on pneumatic power and /or electric power. Operation within specifications continues despite loss of either electric or pneumatic power, providing survivability feature for aircraft.
Author (GRA)

N79-22115# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF MODEL ALGORITHMIC CONTROL TO A LIGHTLY DAMPED SINGLE INPUT SINGLE OUTPUT SYSTEM M.S. Thesis
Howard J. Colson, Jr. Dec. 1978 112 p refs
(AD-A064222; AFIT/GE/EE/78-21) Avail: NTIS HC A06/MF A01 CSCL 01/3

A new digital control technique, called Model Algorithmic Control (MAC), was applied to a single-input single-output model containing complex eigenvalues. The MAC algorithm developed was a simplified version of the algorithm used by ADERSA/GERBIOS Corporation (France) in a complete computer program designated IDCOM (Identification and Command). A second-order model based on the dominant eigenvalues of the B-52E Flutter Mode was selected as the hypothetical system to be controlled. Data were obtained for various selections of control parameters in the implementing program, then a study was made of the controlling program's 'robustness' to eigenvalue changes. The second-order model was subsequently expanded to a third-order, then a fourth-order model, while maintaining the previously found 'optimum' control parameters. Results obtained indicated that the 'robustness' exhibited in the MAC concept as implemented in IDCOM is not attributed to the impulse response prediction technique, but rather must be attributed to the particular control algorithm used in IDCOM. Therefore, before conclusive results could be obtained for robustness and higher-order model studies, further refinement of the simplified MAC algorithm used in this thesis was necessary. A revision to the implementing program was begun, but due to time considerations, was not completed.
Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N79-22116# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EVALUATION OF A REMOTE TONE SIGNALING CONTROL/MONITOR SYSTEM AS LIGHTNING/TRANSIENT PROTECTION FOR SOLID STATE INSTRUMENT LANDING SYSTEMS Final Report, Aug. 1976 - Apr. 1978
James R. Branstetter Jan. 1979 21 p refs
(FAA Proj. 071-713-000)
(AD-A063766; FAA-NA-78-35; FAA-RD-78-149) Avail: NTIS HC A02/MF A01 CSCL 17/7

A new technique in remote control and monitoring of a solid-state instrument landing system was evaluated at the National Aviation Facilities Experimental Center intended as a solution to problems caused by lightning and transients on phone lines and buried cables. The findings show the system effectively reduces or eliminates false transmitter cycling, erroneous status indications, and damage to the ILS equipment.
Author

N79-22117# ARO, Inc., Arnold Air Force Station, Tenn.
CALIBRATION OF THE AEDC-PWT 16-FOOT TRANSONIC TUNNEL AERODYNAMIC TEST SECTION AT VARIOUS REYNOLDS NUMBERS Final Report, Apr. 1976 - Jun. 1978
F. M. Jackson, III Feb. 1979 179 p refs
(AD-A065112; AEDC-TR-78-60) Avail: NTIS HC A09/MF A01

Tests were conducted in the AEDC Propulsion Wind Tunnel (16T) to determine the tunnel test section Mach number distributions and calibration at various Reynolds numbers. Two separate test entries were made. Collectively, the calibration was conducted at Mach numbers from 0.2 to 1.6 and at Reynolds numbers from 500,000/ft to 6 million/ft. The calibration was conducted with the aerodynamic test section (Test Section 2) using a centerline pipe and/or wall pressure orifices to define the Mach number distributions. A quantitative evaluation of the effects of tunnel pressure ratio, test section wall angle, and Reynolds number on the tunnel Mach number distributions and calibration was accomplished. Results indicate that good quality Mach number distributions are obtained for both zero and the optimum wall angle schedule. To obtain the maximum accuracy, the Tunnel 16T calibration must be defined as a function of test section wall angle, Reynolds number, and Mach number. Comparison of this calibration with previous calibration results indicates that a revision in the tunnel calibration used for operations is desirable. Analytical expressions which represent the tunnel calibration at various test conditions were developed for use during Tunnel 16T operations.
GRA

N79-22118# Air Force Human Resources Lab., Brooks AFB, Tex.
ADVANCED SIMULATOR FOR PILOT TRAINING (ASPT): AERIAL REFUELING VISUAL SIMULATION-ENGINEERING Final Report, Sep. 1977 - Feb. 1978
Eric G. Monroe, Kent I. Mehrer, Richard L. Engel, Samuel Hannan, James McHugh, George Turnage, and David R. Lee Sep. 1978 43 p
(AF Proj. 1123)
(AD-A063283; AFHRL-TR-78-51) Avail: NTIS HC A03/MF A01 CSCL 05/9

This report documents the engineering modifications made to the Advanced Simulator for Pilot Training (ASPT) to expand its capability to include aerial refueling simulation. These modifications include the generation of a number of KC-135 tanker models (in various levels of image detail), refueling boom, and director lights. The existing variable/slewable field-of-view program was modified to generate multiple window configurations. The on-line programs were amended to provide boom dynamics operational director lights, and tanker flow field effects. Performance measurement techniques and a dynamic graphics display were programmed to provide an adequate means of assessing and monitoring pilot performance.
Author (GRA)

N79-22119# Logicon, Inc., San Diego, Calif.
DEFINITION OF REQUIREMENTS FOR A PERFORMANCE MEASUREMENT SYSTEM FOR C-5 AIRCREW MEMBERS Final Report, Jun. 1976 - Mar. 1978
Jay R. Swink, Edward A. Butler, Harry E. Lankford, Ralph M. Miller, and Hal Watkins Oct. 1978 76 p
(Contract F33615-76-C-0056)
(AD-A063282; AFHRL-TR-78-54) Avail: NTIS HC A05/MF A01 CSCL 05/9

This study identified and defined C-5 aircrew tasks and performances essential to the effective operation of the aircraft on a typical, representative mission. It described present capabilities of C-5 simulators to determine how these capabilities might be implemented or augmented for measuring crew performance. The results of the above efforts were synthesized into a description of the requirements for a C-5 aircrew performance measurement subsystem. The study also identified

the applicability of these C-5 simulator performance measures to the airborne environment. The capabilities of the C-5 aircraft systems to provide necessary data are described, and the results are synthesized into a functional description for a C-5 inflight performance measurement system. Author (GRA)

N79-22120# General Accounting Office, Washington, D. C. Logistics and Communications Div.
DOD'S COMMENDABLE INITIAL EFFORTS TO SOLVE LAND USE PROBLEMS AROUND AIRFIELDS
Jan. 1979 36 p
(PB-291617/9; LCD-78-341) Avail: NTIS HC A03/MF A01 CSCL 13B

A program for achieving compatible land uses around military airfields is reviewed. It is suggested that the airfield studies where operational changes have occurred be revised to identify more accurate and current noise zones. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-22121# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TECHNOLOGY OF SPACE SHUTTLE VEHICLES, VOLUME 1
1970 600 p refs Lecture held at Rhode-Saint-Genese, Belgium, 23-27 Nov. 1970
(VKI-Lecture-Series-28-Vol-1) Avail: NTIS HC A25/MF A01

Volume 1 of a two volume lecture series is presented. The following topics are discussed: (1) space flight - launch vehicles; (2) hypersonic boundary layers and selected heat flux problems; (3) thermal protection systems for the space shuttle; (4) utilization of space for research and applications; (5) lifting hypersonic vehicles; (6) reusable space vehicles - concepts and considerations; (7) hypersonic vehicles propulsion and aerodynamic problems; and (8) hypersonic ramjets for space shuttle. For individual titles, see N79-22122 through N79-22129.

N79-22122# Tennessee Univ. Space Inst., Tullahoma.
SPACE FLIGHT: LAUNCH VEHICLES **c16**
B. H. Goethert *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 19 p (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

Space flight-launch vehicles, space ferry vehicles and reusable vehicles are discussed in terms of operational characteristics, flexibility, environment, reliability, design concept, payload and air breathing propulsion. Space ferry vehicle operations of the future are also discussed. Graphs are presented which represent launch vehicle cost trends (cost, $1000/pound payload and total cost, million dollars versus payload capability); and vehicle checkout time (performance of air breathing engines). G.Y.

N79-22123# General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.
HYPERSONIC BOUNDARY LAYERS AND SELECTED HEAT FLUX PROBLEMS **c16**
D. E. Nestler *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 42 p refs (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

An attempt is made to introduce the shuttle vehicle community to some of the available engineering techniques of predicting hypersonic boundary layer effects, with emphasis on convective heat flux and boundary layer transition. The primary goal is to present selected representative techniques for each problem area, and to discuss uncertainties, design sensitivities, and future research needs. G.Y.

N79-22124# General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.
THERMAL PROTECTION SYSTEMS (TPS) FOR THE SPACE SHUTTLE **c16**
Dwight E. Florence *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 111 p refs (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

Numerous pertinent studies were sponsored by the NASA, Air Force, and Industry during the past decade that generated a wealth of pertinent data. Some of these studies are reviewed as they relate to the generalized definition of the reentry heating environment and its impact on the various thermal protection system candidates for the space shuttle vehicle. G.Y.

N79-22125*# National Aeronautics and Space Administration, Washington, D. C.
[SOME ACTIVITIES AND VEHICLE CONCEPTS ENVISIONED FOR FUTURE EARTH ORBITAL MISSIONS] **c16**
Bobby G. Noblitt *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 24 p (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01 CSCL 22B

Mission requirements, payloads and vehicles are discussed with regard to their mutual interaction. G.Y.

N79-22126# General Dynamics/Convair, San Diego, Calif.
REUSABLE SPACE VEHICLES, CONCEPTS AND CONSIDERATIONS **c15**
In Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 33 p (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

The initial portion of the discussion is directed at general vehicle concepts which were proposed for reusable space systems. The rational for reusability is presented along with a comparison of various concepts. The latter portion of the discussion considers the fully reusable space shuttle. The various considerations involved in configuration design particularly aero/aerothermodynamic considerations are explained. The problem of abort as it relates to space shuttle program is also discussed. G.Y.

N79-22127# General Dynamics/Convair, San Diego, Calif.
LIFTING HYPERSONIC VEHICLES **c18**
Christopher J. Cohan *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 39 p refs (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

Lifting hypersonic vehicles can be defined as vehicles which employ lift at hypersonic speeds in the accomplishment of their mission. The space shuttle is in the category of recoverable launch vehicles; however, it does operate in reentry vehicle mode. This discussion is directed primarily at lifting entry vehicles since they encompass the complete hypersonic speed regime and many of the factors, which are discussed in relation to entry vehicles, are applicable to other operating modes. At the end of the discussion those factors which are different between reentry vehicles and other operating modes are pointed out. It is the intent of this discussion to treat: (1) the subject of vehicle shape in relation to hypersonic lift to drag, L/D, level; (2) practical considerations of such shapes; and (3) the critical aerodynamic problems of hypersonic shapes. G.Y.

N79-22128# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Applied Aerodynamics Div.
HYPERSONIC VEHICLES PROPULSION AERODYNAMIC PROBLEMS **c07**
R. Ceresuela *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 32 p refs (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

The aerodynamic problems of complete vehicles, and more specifically, the problems raised by the special characteristics of big, light structures integrated with very important engines are addressed. Comments are presented successively on: (1) general problems of lift/drag ratio and of stability; (2) special problems bound to the air - breathing concept; (3) special problems of a proposed space shuttle; (4) elasticity induced problems; (5) fundamental problems such as heating, and prediction of the efficiency of the control surfaces; and (6) cost figures or at least trends for different concepts. G.Y.

N79-22129*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HYPERSONIC RAMJETS FOR SPACE SHUTTLES c20
Kennedy F. Rubert *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 18 p (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01 CSCL 20H

The author briefly describes why he thinks air-breathing propulsion merits serious consideration as an alternative or supplement to rocket propulsion for space shuttle missions. Several aspects of hypersonic ramjet technology are discussed which are indicative of the current state of development and of the compromises which are made in arriving at effective engine configuration concepts. Points of interest in the current NASA Hypersonic Research Engine Project are cited as to exemplify the actual development of a hydrogen-fueled, regeneratively cooled, flight-weight, dual-combustion mode hypersonic ramjet. G.Y.

N79-22130# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TECHNOLOGY OF SPACE SHUTTLE VEHICLES, VOLUME 2
1970 525 p refs Lecture held at Rhode-Saint-Genese, Belgium, 23-27 Nov. 1970
(VKI-Lecture-Series-28-Vol-2) Avail: NTIS HC A22/MF A01

Volume 2 of a two volume lecture series is presented. The following topics are reported: (1) composite (rocket/airbreathing) engines; (2) nonconventional propulsion systems for space shuttle; (3) human factors in space vehicles and space stations; (4) cost analysis of space shuttle vehicles; and (5) space applications for earth-to-low-orbit shuttle vehicles. For individual titles, see N79-22131 through N79-22138.

N79-22131# Rocketdyne, Canoga Park, Calif.
COMPOSITE (ROCKET/AIRBREATHING) ENGINES: KEY TO THE ADVANCED (NON-STAGED) SPACE TRANSPORT VEHICLE c20
W. J. D. Escher *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 76 p refs Also presented at A Short Course in Reusable Launch and Reentry Vehicles for Space Flight Technol. and Appl., Tullahoma, Tenn., 18-22 Aug. 1969 (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

The fully reusable launch/reentry vehicle operating in as close to a commercial airliner mode as is feasible is generally viewed as the principal means of achieving low cost space transportation. Once a truly economic, fully passenger-compatible vehicle is placed into service for the Earth/Low Orbit/Earth transportation cycle an extremely broad range of space development can be economically initiated. With orbital refueling it is possible that the same vehicle can proceed with its passengers and cargo to the moon or to synchronous orbit. G.Y.

N79-22132# Rocketdyne, Canoga Park, Calif.
REGENERATIVE COOLING OF THE SPACE SHUTTLE ENGINE c20
H. C. Wieseneck *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 31 p Also presented at the Space Transportation System Technol. Symp., Cleveland, 15-17 Jul. 1970; sponsored by NASA (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

The high temperature associated with the efficient combustion of rocket propellants necessitates the selection of a cooling technique which reliably maintains safe operating temperatures on all critical components. For all liquid booster propulsion units, such as the J-2 engine (Fig. 1), this task is accomplished by regenerative cooling. The prime assets of regenerative cooling are reliability, durability, and high performance. Those requirements to capabilities and available technology of regenerative cooling are compared. G.Y.

N79-22133# Rocketdyne, Canoga Park, Calif.
COMPOSITE (ROCKET/AIRBREATHING) ENGINES OVERVIEW AND TECHNOLOGY ASSESSMENT c20
W. J. D. Escher *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 41 p (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

The goals, requirements and proposed implementation of composite (rocket/airbreathing) engines for space transportation systems are outlined. The overview and technology assessment are presented in outline form and include graphs and illustrations to highlight the material. G.Y.

N79-22134# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
NON-CONVENTIONAL PROPULSION SYSTEMS FOR SPACE SHUTTLE c20
J. F. Wendt *In its* Technol. of Space Shuttle Vehicles, Vol. 2 1970 11 p refs (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

The words nonconventional propulsion systems mean essentially nonchemical systems. Thus a large class of propulsive systems are possible candidates: electrostatic, magnetohydrodynamic, nuclear fission and possibly nuclear fusion. The various mission requirements during the next generation are discussed. Based on a reasonable extrapolation of existing technology, it will become clear that high-thrust, moderate specific impulse systems will dominate most future programs. The nuclear rocket is shown to be the only realistic 'unconventional' candidate for this role. A discussion of the two basic nuclear rocket configurations (solid core and gaseous core) are discussed, emphasizing the present state of development of each type. G.Y.

N79-22135# Institute of Aviation Medicine, Farnborough (England).
HUMAN FACTORS IN SPACE VEHICLES AND SPACE STATIONS c54
P. Howard *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 37 p (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

The human problems associated with space flight threaten to become more severe as the scale of operations expands, because the small pool of highly selected and exhaustively trained astronauts must be widened and stocked with weaker mortals. Some of the basic stresses that are inherent in all space flights are outlined. Some of the new problems are considered that may arise when the establishment of space stations changes both the nature of the mission and the characteristics of the population at risk. G.Y.

N79-22136# McDonnell-Douglas Corp., St. Louis, Mo.
COST ANALYSIS OF SPACE SHUTTLE VEHICLES c16
Roland Quest *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 41 p Also presented at the Course on Technol. of Space Shuttle Vehicles, Tullahoma, Tenn., 26-30 Oct. 1970 Tennessee Univ. (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

Cost analysis data in the form of charts, graphs and tables are presented. G.Y.

N79-22137*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
OPTIMIZED COST/PERFORMANCE DESIGN METHODOLOGY. VOLUME 2: DATA REVIEW AND ANALYSIS. BOOK 5: COST c16
In Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 208 p refs (For primary document see N79-22130 13-12)
(Contract NAS2-5022)
Avail: NTIS HC A22/MF A01 CSCL 22B

The broad objectives of the study were to gather historical cost and performance data, organize and analyze the data so that cost estimating relationships could be developed, and evaluate several system concepts for space logistics support. The primary source of historical cost data was the Gemini and Saturn Programs and cost estimating relationships draw extensively on this experience. A range of reuse concepts were evaluated and optimum (least cost) concepts defined for a variety of program options. These include variations in such things as crew size, cargo capacity, program requirements, etc. for either ballistic or lifting body (M2-F2) entry vehicles. Author

N79-22138# North American Rockwell Corp., Downey, Calif. Space Div.
SPACE APPLICATIONS FOR EARTH-TO-LOW-ORBIT SHUTTLE VEHICLES
K. A. Ehricke *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 46 p refs Also presented at the Short Course in Reusable Launch and Re-entry Vehicles for Space Flight, Tullahoma, Tenn., Oct. 1970 (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

The Earth-To-Low-Orbit Shuttle (ETLOS) is a space transportation system of crucial importance to future space operations. Its development must be justified in terms of the services it can perform and of the reduction in operating costs obtained by its use, in other words, in terms of its marketability. The point of departure in every discussion of the applications of ETLOS must be the fact that cost-effective delivery of personnel and material into near-Earth orbits supports operations in high-altitude orbits and in deep space as well as in near-earth space. ETLOS is truly the umbilical to space anywhere, because near-earth space is the major staging area for all space operations in the foreseeable future. G.Y.

N79-22139*# Michigan Univ., Ann Arbor.
OPTIMUM REENTRY TRAJECTORIES OF A LIFTING VEHICLE
Jeng-Shing Chern and Nguyen Yuan Vinh [1978] 121 p refs (Grant NsG-1448)
(NASA-CR-158486) Avail: NTIS HC A06/MF A01 CSCL 22A

The optimum maneuver of a space shuttle vehicle reentering a spherical, stationary, and locally exponential atmosphere was investigated. The use of Chapman's modified variables and a rescaled lift-drag polar leads to the formulation of a set of dimensionless equations of motion for flight analysis. The resulting equations are exact in the sense that they are also valid for flight in the vacuum. For planar flight several typical optimum maneuvers are investigated at different altitude ranges, low, moderate and very high. For three-dimensional flight, the procedure to solve the optimum trajectory for maximum cross range is discussed. Finally, using the equilibrium glide condition the maximum cross ranges for entry from circular speed, for several values of E^*, and the footprint for $E^* = 1.5$ are computed in this reduced problem. A.R.H.

N79-22140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jan. 1979 - Feb. 1979
15 Apr. 1979 249 p refs
(Contract NAS7-100)
(NASA-CR-158490; JPL-PR-42-50) Avail: NTIS HC A11/MF A01 CSCL 14B

Deep Space Network progress in flight project support, tracking and data acquisition, research and technology, network engineering, hardware and software implementation, and operations is cited. Topics covered include: tracking and ground based navigation; spacecraft/ground communication; station control and operations technology; ground communications; and deep space stations. For individual titles, see N79-22141 through N79-22171.

N79-22141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1979 p 1-3 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. J.M.S.

N79-22142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DSN PROGRAMMING SYSTEM c61
A. P. Irvine *In its* The Deep Space Network 15 Apr. 1979 p 4-6 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

The DSN (Deep Space Network) Programming System and its current status is described. A recapitulation of the system's description is included as well as major near-term milestones, plans, and some realized benefits. J.M.S.

N79-22143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TESTING AND TRAINING SYSTEM, MARK III-7 c14
D. T. Herrman, Jr. *In its* The Deep Space Network 15 Apr. 1979 p 7-18 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

Implementation of the DSN (Deep Space Network) test and training system, Mark III-77, throughout the network discussed. The Mark III-77 system, as configured, has supported testing and training for the Voyager and Pioneer Venus 1978 missions and all other ongoing, inflight missions. Multimission functions of the system will provide some capabilities for initial DSN test and training preparations for the Galileo project. The DSN test and training system capabilities described include functions performed in the deep space stations, ground communications facility, and network operations control center. J.M.S.

N79-22144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT c14
J. Allen and H. Nance *In its* The Deep Space Network 15 Apr. 1979 p 19-23 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

Deep Space Network operations in support of the Voyager Project are reported for the period from May 1978 through December 1978. Command and telemetry system updates and capability testing are covered. Other areas of support discussed include: radio science; meteorological monitor assembly data; station antenna arraying; range accuracy; and signal enhancement. J.M.S.

N79-22145*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS MULTIPROBE ENTRY MISSION SUPPORT c14
B. Ryan, D. Hollingsworth, A. Bailey, and J. Wells *In its* The Deep Space Network 15 Apr. 1979 p 24-26 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The support of the Pioneer Venus Multiprobe entry event by DSS 42/43 is described. Support included aiding in procedure development, determining staffing requirements, equipment checkout, and determination of final detailed station configuration. J.M.S.

N79-22146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NEAR-EARTH TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER VENUS 1978 MISSIONS c14
M. R. Traxler and H. W. Calhoun *In its* The Deep Space Network 15 Apr. 1979 p 27-35 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The support provided by the near-earth tracking and data system for the Pioneer Venus 1978 missions is described. Mission planning, implementation and configuration, and prelaunch testing are discussed along with orbiter launch support and multiprobe launch support. J.M.S.

N79-22147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ESTIMATED DISPLACEMENTS FOR THE VLBI REFERENCE POINT OF THE DSS 13 26-m ANTENNA c17
H. McGinness, G. Gale, and R. Levy *In its* The Deep Space Network 15 Apr. 1979 p 36-51 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

It is shown that the displacement of the defined reference point caused by bearing runout, temperature change, and wind loading, under expected environmental conditions, will not exceed a few millimeters. J.M.S.

N79-22148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTIPATH EFFECTS ON THE TIME DELAYS OF MICROWAVE CASSEGRAINIAN ANTENNAS c32
T. Y. Otoshi and W. V. T. Rusch (University of Southern California) *In its* The Deep Space Network 15 Apr. 1979 p 52-55 refs (For primary document see N79-22140 13-12)

Avail: NTIS HC A11/MF A01 CSCL 20N

Preliminary results of a theoretical study of multipath errors on antenna time delays are discussed. A computer program was developed to simulate multipath scattering between cone surfaces and the subreflector. Author

N79-22149*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXTRAPOLATED UT1 EFFECT ON VLBI CLOCK SYNCHRONIZATION **c17**
J. W. Layland and B. V. H. Saxberg *In its* The Deep Space Network 15 Apr. 1979 p 56-59 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The two-sample Allen Variance of the extrapolated UT1 numbers was calculated. This calculation was used to infer its effect on DSN clock stability measures obtained via VLBI clock synchronization. For measurement time $T < 300$ s, or $T > 3$ days, the error in UT1 and its variations do not seriously degrade the stability measurement relative to anticipated variations in the clocks themselves. J.A.M.

N79-22150*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RECEIVER DESIGN CONCEPTS FOR DELTA VLBI AND DIFFERENTIAL ONE-WAY RANGE **c17**
J. W. Layland *In its* The Deep Space Network 15 Apr. 1979 p 60-67 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

Three alternative structures for the receiving instrument are described for wideband spacecraft Delta VLBI or differential one-way range navigation. Ways of thinking about the Delta VLBI instrument are introduced that are more closely related to a conventional spacecraft instrument than to a radio-science VLBI instrument. J.A.M.

N79-22151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON IMPROVED RANGING, 2 **c35**
J. W. Layland and A. I. Zygielbaum *In its* The Deep Space Network 15 Apr. 1979 p 68-73 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

A heuristic overview of the principal systematic error sources for ranging and some of the remedies for them was developed. Recommendations are for wider system and range-code bandwidths, and for simplification of the precision-defining form of the range code. J.A.M.

N79-22152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPECTRAL SHAPING WITHOUT SUBCARRIERS **c32**
L. R. Welch (University of Southern California) *In its* The Deep Space Network 15 Apr. 1979 74-76 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

For proper operation of the phase lock loop which tracks a carrier, it is important to minimize the spectral energy at frequencies near the carrier. A traditional method is to modulate the data onto a subcarrier in such a way that there is little energy near dc. The resulting signal is then used to modulate the carrier. The problem with such a scheme is that the total bandwidth is much larger than necessary to transmit the data. A simpler scheme is proposed and analyzed that increases the data bandwidth by a very small fraction, yet reduces the energy near dc to nearly zero. J.A.M.

N79-22153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UNATTENDED OPERATIONS SOFTWARE SYSTEMS DESIGN Progress Report **c61**
L. Lim *In its* The Deep Space Network 15 Apr. 1979 p 78-84 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

A small MBASIC (trademark) program called ORGNIZE was developed to assist the software designer in the organization of MDS PL/M programming modules. It provided a logical way to distribute the various programming procedures in the proper module. The program also provided a consolidated listing of any procedure call and a summary of all procedures used by any procedure call. J.A.M.

N79-22154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL A/D CONVERTER WITH AUTOMATIC DMA BLOCK-TRANSFER CAPABILITY **c60**
D. E. Wallis *In its* The Deep Space Network 15 Apr. 1979 p 85-94 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

A PDP-11 computer-controlled UNIBUS analog-to-digital (A/D) converter was designed and constructed for use in the DSN Planetary Radar Data Acquisition System. The converter is intended for synchronous quadrature-pair sampling and can be programmed to automatically transmit the sample values via direct memory access (DMA) to any desired blocks of memory locations. The converter is described in detail, and information on mechanical construction, data-transfer rates, self-test and calibration provisions, and programming is given. J.A.M.

N79-22155*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NOTE ON DIGITAL SIGNATURES **c32**
R. J. McEliece (Illinois Univ.) *In its* The Deep Space Network 15 Apr. 1979 p 95-96 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

A simplified signal transmission system is described utilizing one way functions. In this system, the message is transmitted digitally from an individual A to another individual B. A signs his messages in such a way that B will be certain that A was the sender. The mathematical scheme on actual verification of the message is described and examples of signal encoding are given. M.M.M.

N79-22156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A GENERAL LOGIC STRUCTURE FOR CUSTOM LSI **c33**
M. W. Sievers *In its* The Deep Space Network 15 Apr. 1979 p 97-105 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

An integrated circuit structure suitable for implementing general combinatorial logic functions in custom large scale integrated circuits is described. The suitability of the structure for building special purpose devices, such as correlators and general purpose controllers, is presented. The utilization of a failure mechanism mapped into the structure is reported. M.M.M.

N79-22157*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EFFICIENT SOFT DECISION DECODING ALGORITHM FOR BLOCK CODING **c61**
H. J. Greenberger *In its* The Deep Space Network 15 Apr. 1979 p 106-109 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

A decoding scheme based on nonoptimum decoding algorithms which select a small set of candidate code words to be correlated with the receiving vector is presented. This algorithm can decode codes which have better performance than those in use today and do not require an unreasonable amount of computation. M.M.M.

N79-22158*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISE EXTRACTION OF GEOMETRICAL DEPENDENCE FROM SOLAR WIND COLUMNAR TURBULENCE MEASUREMENTS **c92**
A. L. Berman *In its* The Deep Space Network 15 Apr. 1979 p 110-118 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

The distortion resulting from reliance on a single geometrical parameter is presented and an approximate relationship between total radial dependence, and the signal path integration of a power law source function is discussed. M.M.M.

N79-22159*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A REEXAMINATION OF THE RADIAL DEPENDENCE OF WEAK INTERPLANETARY SCINTILLATION **c90**
A. L. Berman *In its* The Deep Space Network 15 Apr. 1979 p 119-123 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

The power law radial dependence of the scintillation index is examined. The signal path integration shows total radial dependence of approximately the closet approach distance to

the power of 1/1.5. It was concluded that most manifestions of columnar solar wind turbulence are proportional to signal path integrated electron density. M.M.M.

N79-22160*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A UNIFIED OBSERVATIONAL THEORY FOR SOLAR WIND COLUMNAR TURBULENCE **c92**
A. L. Berman *In its* The Deep Space Network 15 Apr. 1979 p 124-131 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

A picture in which all primary observations of solar wind columnar turbulence are well represented to first order by the signal path integration of a well established electron density model is reported. Experimental measurements of electron density and the primary forms of solar wind columnar turbulence are discussed. A heuristic observational hypothesis for solar wind columnar turbulence consists of: The dependence on radial distance r of solar wind mean electron density N sub e is well represented by the power law model (with A and B fit coefficients): N sub e of r approximately or = to A to the 1/6 power + Br to the 1/2.3 power. To first order, all primary measurements of solar wind columnar turblence are represented by the signal path integration of electron density. This heuristic observational hypothesis conflicts with theoretical interpretations currently in favor. M.M.M.

N79-22161*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FURTHER RESULTS ON FAST TRANSFORMS FOR DECODING REED-SOLOMON CODES OVER GF (2 TO THE N POWER) FOR N EQUALS 4,5,6,8 **c64**
I. S. Reed (University of Southern California), T. K. Truong, R. L. Miller, and B. Benjauthrit *In its* The Deep Space Network 15 Apr. 1979 p 132-155 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 12A

Methods for multiplying two polynomials by the cyclic convolution techniques are developed. Three examples, 3,5, and 15 point cyclic convolutions, are provided. Technical results for simplifying computations over GF(2 to the nth power) are given. These results along with those about cyclic convolutions over GF(2 to the nth power) are used to obtain the finite field transforms of 7 and 9 points. Transforms of length N = 3, 5 and 17 points are given. Finite field transforms of longer lengths, where n = 4,5,6,8, are obtained, using the results given. A comparison of the new algorithm and Gentleman's algorithm is made. A comparison of the two algorithms in terms of the complexity of transform decoding of Reed-Solomon codes over GF(2 to the nth power), n = 4,5,6,8 is provided. M.M.M.

N79-22162*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIDEBAND DATA ERROR RATES **c32**
J. P. McClure *In its* The Deep Space Network 15 Apr. 1979 p 156-160 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

Data on the error and outage characteristics of the ground communications facility's wideband data circuits were gathered and analyzed. Examination of the curves and the data shows: (1) most error events contained only a single block in error. (78% have only a single block in error); (2) long strings of error blocks don't occur. (The longest error event was 28 blocks long); (3) consecutive missing blocks can be quite long. The longest in this set of tests was 9083 blocks, about 13.2 min; (4) the median length of the missing events is around 10 blocks; the typical outage is about 10 blocks long; and (5) an error correction scheme which could span a 1000 block error/outage period would probably correct more than 99% of the gaps. M.M.M.

N79-22163*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTERIZED SIMULATION AND PARAMETERIZATION OF A NEW HIGH-PERFORMANCE TUBULAR SOLAR COLLECTOR **c44**
F. L. Lansing and C. S. Yung *In its* The Deep Space Network 15 Apr. 1979 p 161-180 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

The second of two reports describing the thermal analysis, computerized performance, simulation and performance sensitivity of a vacuum tube solar collector is presented. The collector is considered a potential candidate for future solar heating and cooling applications. The first report presented details of the two-dimensional thermal model of the solar collector at steady state. In this report the second phase of the study is presented to include the computer simulation and the performance parameterization. Comparison of the simulated performance with the manufacturer's test data show good agreement at wide ranges of operating conditions. The effects of nine major design and performance variables on the performance sensitivity are presented. The results of this parameterization study are supportive in detecting the areas of design modification for performance optimization. G.Y.

N79-22164*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DOMSAT CW TRANSMISSION BENT PIPE INVESTIGATION: INITIAL PHASE NOISE MEASUREMENTS VIA RCA SATCOM LINK **c32**
M. H. Brockman and C. E. Jones *In its* The Deep Space Network 15 Apr. 1979 p 181-188 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

A preliminary investigation of a DOMSAT link using a SATCOM stationary Earth satellite and ground station has provided initial phase noise data for continuous-wave radio frequency transmission which is applicable to a bent pipe technique. Author

N79-22165*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN VHF TRANSMITTING ARRAY BACKUP COMMAND UPLINK FOR VOYAGER 2 **c32**
R. M. Dickinson *In its* The Deep Space Network 15 Apr. 1979 p 189-195 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

As a result of the failure of the Voyager 2 primary S-band receiver and the failed component in the remaining receiver, JPL is evaluating the feasibility and cost of an alternate command uplink in the low VHF band around 40 MHz, by utilizing the planetary radio astronomy experiment receiver aboard the spacecraft. The design considerations, tentative specifications and one preliminary mechanization for the requisite ground transmitting facility are presented. The magnitude of the transmitting requirement is on the order of 120 dBm EIRP, achievable with a 183 m diameter phase steered beam array with 250-kW output power. Preliminary results of tests conducted to date employing 46 m diameter steerable parabolic antenna and 300-kW CW VHF transmitter at 46.72 MHz are reviewed. Author

N79-22166*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
X-3060 KLYSTRON DESIGN IMPROVEMENT PROGRAM STATUS **c33**
A. Goldfinger and M. A. Gregg *In its* The Deep Space Network 15 Apr. 1979 pp 106-205 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09A

The X-3060 klystron, a 100 kW continuous wave amplifier klystron, was introduced in 1965. Questions have arisen since its introduction regarding its field performance record but its operational performance was difficult to assess. An early design defect was corrected in 1974 by rebuilding all tubes with an improved potted heater design and only one failure was recorded since that time. However, due to early start up failures, age of the present units, and efforts to establish the most reliable performance possible, a study program was begun to evaluate the klystron design. The results of Phase (1) (Study Definition) and Phase (2) (Design Improvement) of a four-phase program are described. Phase (1) revealed certain weaknesses and design features that conflict with ultrareliable klystron performance. Phase (2) produced a paper design that overcomes the deficiencies and unreliable features shown by the Phase (1) effort. G.Y.

N79-22167*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO FREQUENCY CARRIER ARRAYING **c32**
R. Lay *In its* The Deep Space Network 15 Apr. 1979 p 206-215 ref (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

Carrier arraying of receiving systems provides an improvement in the signal-to-noise ratio relative to a single receiving

system. Measurements using arrays of up to four receiving systems have been conducted to verify the preditcted signal-to-noise ratio improvement. The measured signal-to-noise ratio improvement agrees with the predicted within 0.2 dB. Author

N79-22168*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPECTRAL SIGNAL INDICATOR Progress Report c19
B. Chaney, H. Cooper, and B. Crow *In its* The Deep Space Network 15 Apr. 1979 p 216-218 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The Spectral Signal Indicator was designed as a receiver acquisition aid for the Pioneer Venus Probe entry in December 1978. A description of the Pioneer Venus SSI operation is given, as well as future implementation plans. Author

N79-22169*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-X 34-METER CONVERSION RECEIVER AND MICROWAVE PERFORMANCE c33
H. R. Buchanan *In its* The Deep Space Network 15 Apr. 1979 p 219-225 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09A

The S-X 34-meter conversion provides for upgrading a subnet of three stations to a 34-meter antenna aperture and adding X-band receive capability. This subnet will consist of DSSs 12, 42, and 61. Implementation of DSS 12 was completed in October 1978. A description of the conversion as applied to the antenna microwave and receiver subsystems is given. Performance requirements and test results are included. Author

N79-22170*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPLEMENTATION OF THE DSN VLBI CORRELATOR c14
J. C. Peterson and J. W. Dillon *In its* The Deep Space Network 15 Apr. 1979 P 226-236 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The overall design and current status of the VLBI (Very Long Base Interferometry) Correlator designed to accommodate requirements. The two-station correlator design uses real-time digital computation with microprocessors to perform cross correlation detection of sampled signals in the 0.125 to 2 MHz range. G.Y.

N79-22171*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE SYMBOL SYNCHRONIZER ASSEMBLY c14
M. J. Galitzen *In its* The Deep Space Network 15 Apr. 1979 p 237-242 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The Symbol Synchronizer Assembly (SSA) improvement effort is directed at three goals: to increase the maintainability, operability and reliability within the analog-to-digital conversion portion of the SSA's phase lock look and telemetry data extraction channels. In achieving these goals it was proposed to replace obsolete, nonmaintainable and unreliable electronic and mechanical devices with readily available electronic equipment of modular solid state design. G.Y.

N79-22172*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ORBITING DEEP SPACE RELAY STATION (ODSRS). VOLUME 1: REQUIREMENT DETERMINATION
John A. Hunter 1 Apr. 1979 21 p ref
(Contract NAS7-100)
(NASA-CR-158518; JPL-PUB-79-30-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 22A

The deep space communications requirements of the post-1985 time frame are described and the orbiting deep space relay station (ODSRS) is presented as an option for meeting these requirements. Under current conditions, the ODSRS is not yet cost competitive with Earth based stations to increase DSN telemetry performance, but has significant advantages over a ground station, and these are sufficient to maintain it as a future option. These advantages include: the ability to track a spacecraft 24 hours per day with ground stations located only in the USA; the ability to operate at higher frequencies that would be attenuated by Earth's atmosphere; and the potential for building very large structures without the constraints of Earth's gravity. Author

N79-22173*# Teledyne Brown Engineering, Huntsville, Ala.
LOW GRAVITY FLIGHT COMPLEMENT DATA Final Report
Harry C. Crews, Jr. 30 Mar. 1979 8 p
(Contract NAS8-32711)
(NASA-CR-161210) Avail: NTIS HC A02/MF A01 CSCL 22A

The structural and mechanical design and performance requirements for a space transportation system carrier which will accommodate essentially self-supporting low-g MEA and MAUS facilities are described. Also included are the mission requirements for the materials processing facility and MEA/MAUS experiment flight implementation requirements. J.M.S.

N79-22174*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYNCHRONOUS ORBIT POWER TECHNOLOGY NEEDS
Luther W. Slifer, Jr. and W. J. Billerbeck (COMSAT Labs., Clarksburg, Md.) Apr. 1979 36 p refs
(NASA-TM-80280) Avail: NTIS HC A03/MF A01 CSCL 22A

The needs are defined for future geosynchronous orbit spacecraft power subsystem components, including power generation, energy storage, and power processing. A review of the rapid expansion of the satellite communications field provides a basis for projection into the future. Three projected models, a mission model, an orbit transfer vehicle model, and a mass model for power subsystem components are used to define power requirements and mass limitations for future spacecraft. Based upon these three models, the power subsystems for a 10 kw, 10 year life, dedicated spacecraft and for a 20 kw, 20 year life, multi-mission platform are analyzed in further detail to establish power density requirements for the generation, storage and processing components of power subsystems as related to orbit transfer vehicle capabilities. Comparison of these requirements to state of the art design values shows that major improvements, by a factor of 2 or more, are needed to accomplish the near term missions. However, with the advent of large transfer vehicles, these requirements are significantly reduced, leaving the long lifetime requirement, associated with reliability and/or refurbishment, as the primary development need. A few technology advances, currently under development, are noted with regard to their impacts on future capability. L.S

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N79-22175# Naval Surface Weapons Center, Dahlgren, Va.
EXPLICIT GUIDANCE EQUATIONS FOR A VARIABLE TRIM REENTRY VEHICLE Final Report
T. M. Alexander, Jr. Nov. 1978 24 p refs
(AD-A063655; NSWC/DL-TR-3916) Avail: NTIS HC A02/MF A01 CSCL 17/7

Explicit guidance equations are derived for use with a variable trim reentry vehicle. With a simplifying assumption the equations can be put in a cross product form. Preliminary simulation results have demonstrated the feasibility of the proposed guidance equations. Author (GRA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N79-22141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES

N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1979 p 1-3 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N79-22143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TESTING AND TRAINING SYSTEM, MARK III-7
D. T. Herrman, Jr. *In its* The Deep Space Network 15 Apr. 1979 p 7-18 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N79-22144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT
J. Allen and H. Nance *In its* The Deep Space Network 15 Apr. 1979 p 19-23 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N79-22145*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS MULTIPROBE ENTRY MISSION SUPPORT
B. Ryan, D. Hollingsworth, A. Bailey, and J. Wells *In its* The Deep Space Network 15 Apr. 1979 p 24-26 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N79-22146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NEAR-EARTH TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER VENUS 1978 MISSIONS
M. R. Traxler and H. W. Calhoun *In its* The Deep Space Network 15 Apr. 1979 p 27-35 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N79-22170*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPLEMENTATION OF THE DSN VLBI CORRELATOR
J. C. Peterson and J. W. Dillon *In its* The Deep Space Network 15 Apr. 1979 P 226-236 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N79-22171*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE SYMBOL SYNCHRONIZER ASSEMBLY
M. J. Galitzen *In its* The Deep Space Network 15 Apr. 1979 p 237-242 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-22176# National Oceanic and Atmospheric Administration, Washington, D. C.
PRELAUNCH SUMMARY: NOAA-A LAUNCH
9 Apr. 1979 6 p
(E-615-79-01) Avail: NTIS HC A02/MF A01

The first NOAA-funded operational spacecraft of the TIROS-N series, NOAA-A will be launched from the Western Test Range by an Atlas-F type launch vehicle. The second state which is integral to TIROS-N is a TE-364-15 solid motor which will be used as an injection motor. The Atlas-F /satellite trajectory is a direct ascent, ballistic type trajectory from Pad SLC-3W. The booster state vector at satellite separation produces an apogee altitude of 450 nm at which time the apogee kick motor circularizing burn is accomplished. After apogee kick motor burnout, the orbit is trimmed, the satellite is oriented parallel to the orbit normal, and handover to satellite is accomplished. The mission objectives, environmental sensors, and support systems are described. A.R.H.

N79-22177*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POINTING AND CONTROL SYSTEM ENABLING TECHNOLOGY FOR FUTURE AUTOMATED SPACE MISSIONS
J. B. Dahlgren 30 Dec. 1978 77 p refs
(Contract NAS7-100)
(NASA-CR-158513; JPL-PUB-79-23) Avail: NTIS HC A05/MF A01 CSCL 22B

Future automated space missions present challenging opportunities in the pointing-and-control technology disciplines. The enabling pointing-and-control system technologies for missions from 1985 to the year 2000 were identified and assessed. A generic mission set including Earth orbiter, planetary, and other missions which predominantly drive the pointing-and-control requirements was selected for detailed evaluation. Technology candidates identified were prioritized as planning options for future NASA-OAST advanced development programs. The primary technology thrusts in each candidate program were cited, and advanced development programs in pointing-and-control were recommended for the FY 80 to FY 87 period, based on these technology thrusts. J.M.S.

N79-22178*# Aerojet Electrosystems Co., Azusa, Calif.
SPACE STATION THERMAL CONTROL SURFACES Final Report
C. R. Maag, J. M. Millard, J. A. Jeffery, and R. R. Scott Apr. 1979 387 p refs
(Contract NAS8-32637)
(NASA-CR-161217; Rept-5836) Avail: NTIS HC A17/MF A01 CSCL 22B

Mission planning documents were used to analyze the radiator design and thermal control surface requirements for both space station and 25-kW power module, to analyze the missions, and to determine the thermal control technology needed to satisfy both sets of requirements. Parameters such as thermal control coating degradation, vehicle attitude, self eclipsing, variation in solar constant, albedo, and Earth emission are considered. Four computer programs were developed which provide a preliminary design and evaluation tool for active radiator systems in LEO and GEO. Two programs were developed as general programs for space station analysis. Both types of programs find the radiator-flow solution and evaluate external heat loads in the same way. Fortran listings are included. A.R.H.

N79-22179# National Environmental Satellite Service, Washington, D. C.
THE TIROS-N/NOAA OPERATIONAL SATELLITE SYSTEM
W. John Hussey May 1979 39 p Presented at NOAA-A Sci. Colloq., Washington, D. C., 3 May 1979; Geneva, 5 May 1979
(NOAA-S/T-79-199) Avail: NTIS HC A04/MF A01

The TIROS-N/NOAA-A spacecraft, instrument payload, and the ground data processing and handling system operated by NOAA are discussed. The capabilities of TIROS include: (1) Higher resolution, day and night cloud cover observations on a local and global scale; (2) Improved observations of vertical temperature and water vapor profiles on a global scale; and (3) First operational flight of a high capacity data collection and platform location system. S.E.S.

N79-22180# Hughes Research Labs., Malibu, Calif.
SATELLITE POSITIVE ION BEAM SYSTEM Final Report, 1 Oct. 1975 - 30 Oct. 1978
Tommy Masek Oct. 1978 251 p refs
(Contract F19628-76-C-0060; AF Proj. 6690)
(AD-A063964; AFGL-TR-78-0141) Avail: NTIS HC A12/MF A01 CSCL 20/7

The Satellite Positive Ion Beam Systems (SPIBS) program was initiated by the Air Force Geophysics Laboratory (AFGL) Aeronomy Division with the long-range objective of operating an ion-ejection instrument on the Air Force SCATHA (Spacecraft Charging at High Altitude) satellite. This report describes the development details for breadboard, engineering, and flight models of the SPIBS instrument. A fourth model, a rocket model SPIBS, was built for use in a rocket charging experiment. This report provides a description of all phases of the SPIBS instrument development process and the key technical difficulties and successes. Corroborative results obtained by AFGL personnel using the delivered instruments are referred to as appropriate to support the most significant conclusions. GRA

N79-22181# Ohio State Univ., Columbus. Dept. of Geodetic Science.
IMPROVED PROCEDURES FOR THE RECOVERY OF 5 DEGREES MEAN GRAVITY ANOMALIES FROM ATS-6/GEOS-3 SATELLITE TO SATELLITE RANGE-RATE OBSERVATIONS USING LEAST SQUARE COLLOCATION
D. P. Hajela Sep. 1978 45 p refs
(Contract F19628-76-C-0010; AF Proj. 7600)
(AD-A063990; DGS-276; SCIENTIFIC-20; AFGL-TR-78-0260) Avail: NTIS HC A03/MF A01 CSCL 22/3

The prediction of 5 deg mean gravity anomalies is considered by collocation from ATS-6/GEOS-3 satellite to satellite range-rate observations. The auto and cross-covariances of the residual line of sight accelerations R-double dot from GEOS-3 to ATS-6 are computed rigorously in the anomalous potential field. The raw residual range-rate R-dot values are filtered and smoothed by approximating them in a least squares sense by a cubic spline function, and the residual accelerations R-double dot are obtained as the first derivatives of the spline. Experiments are described to fit the raw R-dot values by a spline function with variable knots, and to remove any linear trend from R-double dot values due to residual errors in initial state vectors. The correlation coefficients between the predicted values of neighboring anomalies are considered. In spite of low density of range-rate data directly over the anomalies, and the high noise level of the destruct-Doppler data, it appears that 5 deg anomalies can be predicted with a standard deviation of 6 mgals. It is found that these predicted anomalies agree much better with the altimeter anomalies than the anomalies implied by PGS 110 field. GRA

N79-22182# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
LANCE CONFIGURATION Q-FLEX ACCELEROMETER DESIGN VERIFICATION
Joe S. Hunter 6 Sep. 1978 40 p refs
(AD-A063901; DRDMI-T-78-91) Avail: NTIS HC A03/MF A01 CSCL 17/7

Sundstrand Data Control (SDC), Inc. was awarded a contract during August 1977 to perform design analysis, fabrication and testing on three Quartz Flexure Accelerometers built to meet the requirements of Lance Missile Interim Specification (MIS) Number 13227C, dated 24 September 1975. The main thrust of the program with Sundstrand was to improve the Q-Flex Accelerometer performance in the area of bias thermal hysteresis (BTH). The design analysis portion of the program was performed to establish alternative methods to improve BTH.
Author (GRA)

N79-22183# Dayton Univ., Ohio. School of Engineering.
USAF/ASEE SUMMER FACULTY PROGRAM RESEARCH ON DESIGN ANALYSIS FOR DUAL-MODE AIR-LAUNCHED MISSILE SYSTEM, VOLUME 1 Final Technical Report, Jun. - Aug. 1978
Jay D. Pinson, Donald E. Lewis, Fred Orazio, F. Gerard Albers, Albert W. Biggs, John N. Crisp, Thomas C. Evans, Jr., Elayne A. Idowu, Leo R. Maier, Jr., James O. Nichols et al Dec. 1978 17 p
(Contract F49620-78-C-0011; AF Proj. 2307)
(AD-A064973; UDR-TR-79-04-Vol-1; UDSE-TR-78-13-Vol-1; AFOSR-79-0064TR) Avail: NTIS HC A02/MF A01 CSCL 16/4

This report represents the results of an analysis of major technical aspects of the advanced strategic air launched missile (ASALM) system concept as developed independently by two aerospace contractors for the U.S. Air Force. The objectives were to: provide the Air Force with an independent assessment of the technical risks associated with the major system and sub-systems of an ASALM, identification and analysis of critical ASALM performance parameters which offset overall system effectiveness, and identification of system design tradeoffs in high technical risk areas which would optimize overall system effectiveness. The Study Group investigated the major subsystems area from the viewpoint of a totally integrated weapon system in order to assess the system performance, identify critical problem areas and identify major discrepancies in the estimation of the life cycle cost. Basically, the value of this effort is established in the reinforcement of the importance of those critical technology and performance factors which could delay the progress or degrade the performance of the proposed weapon system. Thus the data and comments reported as a result of this investigation will assist in formulation of criteria for the selection of a final Advanced Air Launched Strategic System. GRA

N79-22126# General Dynamics/Convair, San Diego, Calif.
REUSABLE SPACE VEHICLES, CONCEPTS AND CONSIDERATIONS
In Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 33 p (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-22184*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AERODYNAMIC CHARACTERISTICS OF THE 140A/B SPACE SHUTTLE ORBITER AT MACH 10.3
Peter T. Bernot May 1979 46 p refs
(NASA-TM-80086; L-12675) Avail: NTIS HC A03/MF A01 CSCL 22B

A wind-tunnel investigation was conducted to determine the static longitudinal and lateral-directional characteristics of the 140/B space shuttle orbiter configurations. A 0.010-scale model was tested at angles of attack from 12 deg to 36.5 deg at Reynolds numbers ranging from 0.62 x to 1.33 x based on fuselage reference length. Stability, control, and performance characteristics were obtained for several deflections of the elevons and body flap. Effects of aileron deflection on roll control and longitudinal stability were also measured. The results indicate that the orbiter is neutrally stable at a 20 degs angle of attack with control deflections set at 0 degs and the center of gravity at 65 percent of fuselage length. For a typical entry attitude of 30 degs stable trim resulting in a lift-drag ratio of 1.40 is possible. Increasing the Reynolds number yielded higher values of lift-drag ratio, but only for angles of attack up to 24 degs. The orbiter is directionally unstable with positive dihedral effect. Aileron deflection resulted in adverse yaw to roll control and also caused negative increments in pitching moment over the test angle-of-attack range. L.S.

N79-22185# General Electric Co., Philadelphia, Pa. Space Div.
STANDARD TEST RACK EXPLOITATION STUDY Final Report, 7 Jul. - 31 Dec. 1977
William P. Engle Dec. 1977 396 p refs
(Contract F04701-77-C-0116)
(AD-A064773; SAMSO-TR-77-190) Avail: NTIS HC A17/MF A01 CSCL 22/2

The Standard Test Rack (STR), designed to handle a wide variety of experiments and operational payloads, can fly on the space shuttle with a minimum of lead time and within a small space envelope. It is configured to use left-over space including fitting around the space lab tunnel. Minimum interface with the shuttle support systems provides ability for quick reaction installation on a space availability basis. Author (GRA)

N79-22186# TRW Defense and Space Systems Group, Redondo Beach, Calif.
STS UTILIZATION STUDY EXPERIMENT ASSESSMENTS Technical Operating Report, 30 Jun. 1977 - 30 Dec. 1977
30 Dec. 1977 315 p
(Contract F04701-77-C-0112)
(AD-A064766; TRW-31933-6001-RU-00) Avail: NTIS HC A14/MF A01 CSCL 22/2

A study was performed to identify those experiments from DoD laboratories that will be able to use the Space Transportation System (STS). Applicable experiments were assessed to determine the most effective carrier system within the STS. Design suggestions were made to improve experiment compatibility with

the STS. The report describes the study, includes the experiment assessments and data on payload accommodation capability of elements of the STS. It is concluded that a considerable amount of DoD space flight experimentation can be projected for the STS flight era. Most experiments will require one of the payload carriers, now under development, to interface with the Orbiter. Many will require the use of special flight support equipment such as a pointing system. In a specific area, it was found that there is basic materials research within DoD that might benefit from space experimentation. Author (GRA)

N79-22187# TRW Defense and Space Systems Group, Redondo Beach, Calif.
STS UTILIZATION STUDY Final Report
30 Dec. 1977 61 p
(Contract F04701-77-C-0112)
(AD-A064681; TRW-31933-6002-RU-00; SAMSO-TR-77-189)
Avail: NTIS HC A04/MF A01 CSCL 22/2

A study was performed to identify those experiments from DoD laboratories that will be able to use the Space Transportation System (STS). Applicable experiments were assessed to determine the most effective carrier system within the STS. Design suggestions were made to improve experiment compatibility with the STS. The report describes the study and includes examples of the experiment assessments. It is concluded that a considerable amount of DoD space flight experimentation can be projected for the STS flight era. Most experiments will require one of the payload carriers, now under development, to interface with the Orbiter. Many will require the use of special flight support equipment such as a pointing system. In a specific area, it was found that there is basic materials research within DoD that might benefit from space experimentation. Author (GRA)

N79-22006*# Rockwell International Corp., Downey, Calif. Space Systems Group.
AERODYNAMIC DESIGN OF THE SPACE SHUTTLE ORBITER
W. E. Bornemann and T. E. Surber *In* AGARD High Angle of Attack Aerodyn. Jan. 1979 24 p refs (For primary document see N79-21996 13-01)
(Contract NAS9-14000)
Avail: NTIS HC A23/MF A01 CSCL 22B

N79-22122# Tennessee Univ. Space Inst., Tullahoma.
SPACE FLIGHT: LAUNCH VEHICLES
B. H. Goethert *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 19 p (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

N79-22123# General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.
HYPERSONIC BOUNDARY LAYERS AND SELECTED HEAT FLUX PROBLEMS
D. E. Nestler *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 42 p refs (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

N79-22124# General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.
THERMAL PROTECTION SYSTEMS (TPS) FOR THE SPACE SHUTTLE
Dwight E. Florence *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 111 p refs (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

N79-22125*# National Aeronautics and Space Administration, Washington, D. C.
[SOME ACTIVITIES AND VEHICLE CONCEPTS ENVISIONED FOR FUTURE EARTH ORBITAL MISSIONS]
Bobby G. Noblitt *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 24 p (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01 CSCL 22B

N79-22136# McDonnell-Douglas Corp., St. Louis, Mo.
COST ANALYSIS OF SPACE SHUTTLE VEHICLES
Roland Quest *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 41 p Also presented at the Course on Technol. of Space Shuttle Vehicles, Tullahoma, Tenn., 26-30 Oct. 1970 Tennessee Univ. (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

N79-22137*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
OPTIMIZED COST/PERFORMANCE DESIGN METHODOLOGY. VOLUME 2: DATA REVIEW AND ANALYSIS. BOOK 5: COST
In Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 208 p refs (For primary document see N79-22130 13-12)
(Contract NAS2-5022)
Avail: NTIS HC A22/MF A01 CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N79-22147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ESTIMATED DISPLACEMENTS FOR THE VLBI REFERENCE POINT OF THE DSS 13 26-m ANTENNA
H. McGinness, G. Gale, and R. Levy *In its* The Deep Space Network 15 Apr. 1979 p 36-51 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-22149*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXTRAPOLATED UT1 EFFECT ON VLBI CLOCK SYNCHRONIZATION
J. W. Layland and B. V. H. Saxberg *In its* The Deep Space Network 15 Apr. 1979 p 56-59 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-22150*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RECEIVER DESIGN CONCEPTS FOR DELTA VLBI AND DIFFERENTIAL ONE-WAY RANGE
J. W. Layland *In its* The Deep Space Network 15 Apr. 1979 p 60-67 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-22188*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE SPACE SYSTEM: CHARGED PARTICLE ENVIRONMENT INTERACTION TECHNOLOGY
N. John Stevens, James C. Roche, and Normant T. Grier 1979 23 p refs Presented at the Conf. on Advanced Technol. for Future Space Systems, Hampton, Va., 8-11 May 1979; sponsored by AIAA

(NASA-TM-79156; E-012) Avail: NTIS HCA02/MF A01 CSCL 22B

Large, high voltage space power systems are proposed for future space missions. These systems must operate in the charged-particle environment of space and interactions between this environment and the high voltage surfaces are possible. Ground simulation testing indicated that dielectric surfaces that usually surround biased conductors can influence these interactions. For positive voltages greater than 100 volts, it has been found that the dielectrics contribute to the current collection area. For negative voltages greater than-500 volts, the data indicates that the dielectrics contribute to discharges. A large, high-voltage power system operating in geosynchronous orbit was analyzed. Results of this analysis indicate that very strong electric fields exist in these power systems. S.E.S.

N79-22189# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

SPACECRAFT CHARGING M.S. Thesis

Richard A. Passo Dec. 1978 105 p refs (AD-A064754; AFIT/GNE/PH/78-19) Avail: NTIS HC A06/MF A01 CSCL 20/3

If a spacecraft is exposed to a steady stream of current density, the charge of which is deposited on the surface of a cylindrical conducting spacecraft, internal electromagnetic fields are generated. If the internal fields are of sufficient strength, undesirable electronic noise or damage may result. This thesis presents three approaches for calculating the induced electric field: Separation of variables, variational calculus, and the use of Green's functions. The spacecraft is modeled as a hollow, infinite cylinder. The fields are calculated for the case in which the incoming current is incident perpendicularly to the longitudinal axis of the cylinder. Basic electro-static theory reveals that the governing equation for the potential is Laplace's Equation, subject to Neumann boundary conditions. This equation is first solved by separation of variables. The electric field predicted for representive values in incoming current density are on the order of 10 to the minus 7th power volts/meter. The Green's function approximations of the potential distribution were consistent with analytic results to at least two significant figures. GRA

N79-22127# General Dynamics/Convair, San Diego, Calif.

LIFTING HYPERSONIC VEHICLES

Christopher J. Cohan *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 39 p refs (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N79-22168*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPECTRAL SIGNAL INDICATOR Progress Report

B. Chaney, H. Cooper, and B. Crow *In its* The Deep Space Network 15 Apr. 1979 p 216-218 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-22190*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRIMARY ELECTRIC PROPULSION FOR FUTURE SPACE MISSIONS

David C. Byers, Fred F. Terdan, and Ira T. Myers 1979 45 p refs Presented at the Conf. on Adv. Technol. for Future Space Systems, Langley, Va., 8-11 May 1979; sponsored in part by AIAA
(NASA-TM-79141; E-9994) Avail: NTIS HC A03/MF A01 CSCL 20C

A general methodology is presented which allows prediction of the overall characteristics of thrust systems employing electron-bombardment ion thrusters. Elements of the thrust system are defined and their characteristics presented in a parametric fashion. Two system approaches are evaluated where power management and control elements and thruster characteristics were substantially different. For an assumed system approach, the methodology presented predicts overall system properties, such as input power and mass, when major mission and thrust system parameters, such as trip time and specific impulse, are assumed. Author

N79-22191*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RESULTS FROM SYMPOSIUM ON FUTURE ORBITAL POWER SYSTEMS TECHNOLOGY REQUIREMENTS

Sol Gorland 1979 8 p refs To be presented at the 14th Intersoc. Energy Conversion Eng. Conf., Boston, 5-10 Aug. 1979; sponsored by the Am. Chem. Soc.
(NASA-TM-79125; E-9961) Avail: NTIS HC A02/MF A01 CSCL 10B

The technology requirements for future orbital power systems were reviewed. Workshops were held in 10 technology disciplines to discuss technology deficiencies, adequacy of current programs to resolve those deficiencies and recommendations for tasks that might reduce the testing and risks involved in future orbital energy systems. Those recommendations are summarized. J.M.S.

N79-22192*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INCREASED CAPABILITIES OF THE 30-cm DIAMETER Hg ION THRUSTER

Vincent K. Rawlin and Charles E. Hawkins 1979 22 p refs Presented at the Conf. on Advanced Technol. for Future Space Systems, Langley, Va., 8-11 May 1979; sponsored by AIAA
(NASA-TM-79142; E-9995) Avail: NTIS HC A02/MF A01 CSCL 21C

Some space flight missions require advanced ion thrusters which operate at conditions much different than those for which the baseline 30-cm Hg thruster was developed. Results of initial tests of a 30-cm Hg thruster with two and three grid ion accelerating systems, operated at higher values of both thrust and power and over a greater range of specific impulse than the baseline conditions are presented. Thruster lifetime at increased input power was evaluated both by extended tests and real time spectroscopic measurements. Author

N79-22193*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN ECONOMIC ANALYSIS OF A COMMERCIAL APPROACH TO THE DESIGN AND FABRICATION OF A SPACE POWER SYSTEM

Zimri Putney (Solarex Corp., Rockville, Md.) and Julian Been 1979 8 p refs Presented at the Conf. on Adv. Technol. for Future Space Systems, Hampton, 8-11 May 1979; sponsored by AIAA
(NASA-TM-79153; E-1009) Avail: NTIS HC A02/MF A01 CSCL 10A

A commercial approach to the design and fabrication of an economical space power system is presented. Cost reductions are projected through the conceptual design of a 2 kW space power system built with the capability for having serviceability. The approach to system costing that is used takes into account both the constraints of operation in space and commercial production engineering approaches. The cost of this power system reflects a variety of cost/benefit tradeoffs that would reduce system cost as a function of system reliability requirements,

complexity, and the impact of rigid specifications. A breakdown of the system design, documentation, fabrication, and reliability and quality assurance cost estimates are detailed. J.M.S.

N79-22129*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HYPERSONIC RAMJETS FOR SPACE SHUTTLES
Kennedy F. Rubert *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 1 1970 18 p (For primary document see N79-22121 13-12)
Avail: NTIS HC A25/MF A01 CSCL 20H

N79-22131# Rocketdyne, Canoga Park, Calif.
COMPOSITE (ROCKET/AIRBREATHING) ENGINES: KEY TO THE ADVANCED (NON-STAGED) SPACE TRANSPORT VEHICLE
W. J. D. Escher *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 76 p refs Also presented at A Short Course in Reusable Launch and Reentry Vehicles for Space Flight Technol. and Appl., Tullahoma, Tenn., 18-22 Aug. 1969 (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

N79-22132# Rocketdyne, Canoga Park, Calif.
REGENERATIVE COOLING OF THE SPACE SHUTTLE ENGINE
H. C. Wieseneck *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 31 p Also presented at the Space Transportation System Technol. Symp., Cleveland, 15-17 Jul. 1970; sponsored by NASA (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

N79-22133# Rocketdyne, Canoga Park, Calif.
COMPOSITE (ROCKET/AIRBREATHING) ENGINES OVERVIEW AND TECHNOLOGY ASSESSMENT
W. J. D. Escher *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 41 p (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

N79-22134# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
NON-CONVENTIONAL PROPULSION SYSTEMS FOR SPACE SHUTTLE
J. F. Wendt *In its* Technol. of Space Shuttle Vehicles, Vol. 2 1970 11 p refs (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-22194*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED ADHERENCE OF SPUTTERED TITANIUM CARBIDE COATINGS ON NICKEL- AND TITANIUM-BASE ALLOYS
Donald R. Wheeler and William A. Brainard Apr. 1979 18 p refs
(NASA-TP-1450; E-9838) Avail: NTIS HC A02/MF A01 CSCL 11F

Rene 41 and Ti-6Al-4V alloys were radio frequency sputter coated with titanium carbide by several techniques in order to determine the most effective. Coatings were evaluated in pin-on-disk tests. Surface analysis by X-ray photoelectron spectroscopy was used to relate adherence to interfacial chemistry. For Rene 41, good coating adherence was obtained when a small amount of acetylene was added to the sputtering plasma. The acetylene carburized the alloy surface and resulted in better bonding to the TiC coating. For Ti-6Al-4V, the best adherence and wear protection was obtained when a pure titanium interlayer was used between the coating and the alloy. The interlayer is thought to prevent the formation of a brittle, fracture-prone, aluminum oxide layer. Author

N79-22195# Texas Univ. at Austin. Dept. of Chemistry.
SYNTHESIS OF ORGANOFLUORINE COMPOUNDS BY DIRECT FLUORINATION Final Report, 30 Jun. 1976 - 30 Jun. 1978
Richard J. Lagow Jun. 1978 16 p refs
(Grant AF-AFOSR-3031-76; AF Proj. 2303)
(AD-A064561; AFOSR-79-0024TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

Final report of research done utilizing a fluorination technique for the synthesis of perfluorinated and polyfluorinated organic compounds is given. Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N79-22196*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CARBON FIBER RISK ANALYSIS
1979 245 p An Ind./Govt. briefing held at Hampton, Va., 31 Oct. 1978 - 1 Nov. 1978
(NASA-CP-2074; L-12723) Avail: NTIS HC A11/MF A01 CSCL 11D

The scope and status of the effort to assess the risks associated with the accidental release of carbon/graphite fibers from civil aircraft is presented. Vulnerability of electrical and electronic equipment to carbon fibers, dispersal of carbon fibers, effectiveness of filtering systems, impact of fiber induced failures, and risk methodology are among the topics covered. For individual titles, see N79-22197 through N79-22209.

N79-22197*# National Aeronautics and Space Administration, Washington, D. C.
THE NATIONAL CARBON FILTER PROGRAM
Leonard Harris *In* NASA. Langley Res. Center Carbon Fiber Risk Anal. 1979 p 7-13 (For primary document see N79-22196 13-24)
Avail: NTIS HC A11/MF A01 CSCL 11D

An action plan formulated to address the rapid growth in the use of graphite reinforced composite materials and the potential for the release of free fibers is outlined. The role of various agencies with respect to the civil sector of the user community is discussed. Emphasis is placed on NASA responsibilities in the area of quantifying the risk associated with the use of graphite bearing composites in aircraft. J.M.S.

N79-22198*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RISK ANALYSIS APPROACH
Robert J. Huston *In its* Carbon Fiber Risk Anal. 1979 p 15-27 (For primary document see N79-22196 13-24)
Avail: NTIS HC A11/MF A01 CSCL 11D

The assessment of the carbon fiber hazard is outlined. Program objectives, requirements of the risk analysis, and elements associated with the physical phenomena of the accidental release are described. J.M.S.

N79-22199*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CARBON FIBERS AND COMPOSITES
Richard A. Pride *In its* Carbon Fiber Risk Anal. 1979 p 29-40 (For primary document see N79-22196 13-24)
Avail: NTIS HC A11/MF A01 CSCL 11D

The basic nature of composite materials is considered. Carbon fiber composites and their area of current and planned application in civil aircraft are discussed, specifically within the framework of the various aspects of risk analysis. J.M.S.

N79-22200*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOURCE OF RELEASED CARBON FIBERS
Vernon L. Bell *In its* Carbon Fiber Risk Anal. 1979 p 41-71 (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

The potential for the release of carbon fibers from aircraft crashes/fires is addressed. Simulation of the conditions of aircraft crash fires in order to predict the quantities and forms of fibrous materials which might be released from civilian aircraft crashes/fires is considered. Figures are presented which describe some typical fiber release test activities together with some very preliminary results of those activities. The state of the art of carbon fiber release is summarized as well as some of the uncertainties concerning accidental fiber release. J.M.S.

N79-22201*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DISSEMINATION, REDISSEMINATION AND FIBER LIFE

Wolf Eiber *In its* Carbon Fiber Risk Anal. 1979 p 73-97 refs (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

The technical background of dissemination of carbon fibers as well as the possibility of redissemination and fiber life are outlined. Plume spread and weather, measures of pollution and of damage potential, and parameters controlling dissemination patterns are among the topics discussed. It is shown that the redissemination rate off hard surfaces decreases with time and that fiber length decreases with time. Redissemination from vegetated land is shown to be insignificant. J.M.S.

N79-22202*# Bionetics Corp., Hampton, Va.

TRANSFER FUNCTIONS

Isreal Taback *In* NASA. Langley Res. Center Carbon Fiber Risk Anal. 1979 p 99-107 (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

The vulnerability of electronic equipment to carbon fibers is studied. The effectiveness of interfaces, such as filters, doors, window screens, and cabinets, which affect the concentration, exposure, or deposition of carbon fibers on both (internal and external) sides of the interface is examined. The transfer function of multilayer aluminum mesh, wet and dry, polyurethane foam, and window screen are determined as a function of air velocity. Filters installed in typical traffic control boxes and air conditioners are also considered. J.M.S.

N79-22203*# Bionetics Corp., Hampton, Va.

VULNERABILITY

Isreal Taback *In* NASA. Langley Res. Center Carbon Fiber Risk Anal. 1979 p 109-123 (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

The discussion of vulnerability begins with a description of some of the electrical characteristics of fibers before definiting how vulnerability calculations are done. The vulnerability results secured to date are presented. The discussion touches on post exposure vulnerability. After a description of some shock hazard work now underway, the discussion leads into a description of the planned effort and some preliminary conclusions are presented. G.Y.

N79-22204*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

END-TO-END TESTING

Richard A. Pride *In its* Carbon Fiber Risk Anal. 1979 p 125-139 (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

The principle objective of the kinds of demonstration tests that are discussed is to try to verify whether or not carbon fibers that are released by burning composite parts in an aircraft-fuel fires can produce failures in electrical equipment. A secondary objective discussed is to experimentally validate the analytical models for some of the key elements in the risk analysis. The approach to this demonstration testing is twofold: limited end-to-end test are to be conducted in a shock tube; and planning for some large outdoor burn tests is being done. G.Y.

N79-22205*# Bionetics Corp., Hampton, Va.

SURVEYS FOR SENSITIVITY TO FIBERS AND POTENTIAL IMPACTS FROM FIBER INDUCED FAILURES

A. J. Butterfield *In* NASA. Langley Res. Center Carbon Fiber Risk Anal. 1979 p 141-158 (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

The surveys for sensitivities to fibers and potential impacts from fiber induced failures begins with a review of the survey work completed to date and then describes an impact study involving four industrial installations located in Virginia. The observations and results from both the surveys and the study provide guidelines for future efforts. The survey work was done with three broad objectives: (1) identify the pieces of potentially vulnerable equipment as candidates for test; (2) support the transfer function work by gaining an understanding of how fibers could get into a building; and (3) support the economic analysis by understanding what would happen if fibers precipitated a failure in an item of equipment. G.Y.

N79-22206*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

RISK METHODOLOGY OVERVIEW

Karen R. Credeur *In its* Carbon Fiber Risk Anal. 1979 p 159-171 (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

Some considerations of risk estimation, how risk is measured, and how risk analysis decisions are made are discussed. Specific problems of carbon fiber release are discussed by reviewing the objective, describing the main elements, and giving an example of the risk logic and outputs. G.Y.

N79-22207*# ORI, Inc., Silver Spring, Md.

AN ASSESSMENT OF LOCAL RISK

Leon Pocinki *In* NASA. Langley Res. Center Carbon Fiber Risk Anal. 1979 p 173-198 (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

A status report is presented on the assessment of the risk at Washington National Airport and the surrounding Washington, D.C. area associated with commercial operations of aircraft with graphite fiber composite in their structures. The presentation is outlined as follows: (1) overall strategy; (2) need for individual airport results; (3) airport-metro area model - submodels, method, assumptions and data; and (4) preliminary results for National Airport - D.C. area. G.Y.

N79-22208*# Little (Arthur D.), Inc., Washington, D. C.

AN ASSESSMENT OF NATIONAL RISK: GENERAL CONCEPTS AND OVERALL APPROACH

Ashok Kalelkar *In* NASA. Langley Res. Center Carbon Fiber Risk Anal. 1979 p 199-234 (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

The analysis of risk presented by carbon fiber utilization in commercial aviation is reported. The discussion is presented in three parts: (1) general concepts; (2) overall approach; and (3) risk evaluation and perspective. G.Y.

N79-22209*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CARBON FIBER RISK ANALYSIS: CONCLUSIONS

Robert J. Huston *In its* Carbon Fiber Risk Anal. 1979 p 235-248 (For primary document see N79-22196 13-24)

Avail: NTIS HC A11/MF A01 CSCL 11D

It was concluded that preliminary estimates indicate that the public risk due to accidental release of carbon fiber from air transport aircraft is small. It was also concluded that further work is required to increase confidence in these estimates. G.Y.

N79-22210*# California Univ., Livermore. Lawrence Livermore Lab.

HIGH-PERFORMANCE FIBER/EPOXY COMPOSITE PRESSURE VESSELS

T. T. Chiao, M. A. Hamstad, E. S. Jessop, and R. H. Toland 12 Dec. 1978 49 p refs

(Contract W-7405-eng-48; NASA Order C-13980-C)

(NASA-CR-159512; UCRL-52533) Avail: NTIS HC A02/MF A01 CSCL 11D

Activities described include: (1) determining the applicability of an ultrahigh-strength graphite fiber to composite pressure vessels; (2) defining the fatigue performance of thin-titanium-lined, high-strength graphite/epoxy pressure vessel; (3) selecting epoxy

resin systems suitable for filament winding; (4) studying the fatigue life potential of Kevlar 49/epoxy pressure vessels; and (5) developing polymer liners for composite pressure vessels. Kevlar 49/epoxy and graphite fiber/epoxy pressure vessels, 10.2 cm in diameter, some with aluminum liners and some with alternation layers of rubber and polymer were fabricated. To determine liner performance, vessels were subjected to gas permeation tests, fatigue cycling, and burst tests, measuring composite performance, fatigue life, and leak rates. Both the metal and the rubber/polymer liner performed well. Proportionately larger pressure vessels (20.3 and 38 cm in diameter) were made and subjected to the same tests. In these larger vessels, line leakage problems with both liners developed the causes of the leaks were identified and some solutions to such liner problems are recommended. A.R.H.

N79-22211*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEVELOPMENT AND FABRICATION OF HIGH STRENGTH ALLOY FIBERS FOR USE IN METAL-METAL MATRIX COMPOSITES

G. W. King (Westinghouse Electric Corp., Bloomfield, N. J.) and D. W. Petrasek 1979 15 p refs Presented at the 108th Ann. Meeting of the Am. Inst. of Mining, Met. and Petroleum Engr., New Orleans, 18-22 Feb. 1979
(NASA-TM-79115; E-9951) Avail: NTIS HC A02/MF A01 CSCL 11D

Metal fiber reinforced superalloys are being considered for construction of critical components in turbine engines that operate at high temperature. The problems involved in fabricating refractory metal alloys into wire form in such a manner as to maximize their strength properties without developing excessive structural defects are described. The fundamental principles underlying the development of such alloy fibers are also briefly discussed. The progress made to date in developing tungsten, tantalum and columbium base alloys for fiber reinforcement is reported and future prospects for alloy fiber development considered. Author

N79-22212# Indian Inst. of Tech., Bombay.

FRACTURE RESISTANCE OF RANDOM FIBER GLASS COMPOSITES

A. C. Garg and C. K. Trotman (Cranfield Inst. of Tech.) 24 Apr. 1979 29 p refs
Avail: NTIS HC A03/MF A01

The concept of crack growth resistance curve (R-curve) was applied to random fiber glass composites and analytical relations for R-curves were obtained. The effect of thickness and the procedure of lamination is studied. Thickness does not affect significantly the fracture characteristics. The analytical relations for R-curve are used to predict the residual strength characteristics and the fracture toughness. Author

N79-22213# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

BUCKLING OF CONTINUOUS FILAMENT ADVANCED COMPOSITE ISOGRID WIDE COLUMNS IN AXIAL COMPRESSION Final Scientific Report, 1 Mar. 1977 - 30 Jun. 1978

Lawrence W. Rehfield and Ravi B. Deo Nov. 1978 65 p refs
(Contract F49620-77-C-0077; AF Proj. 2307)
(AD-A064783; AFOSR-79-0021TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report contains a summary of research performed to explore the potential of a new, promising structural concept--continuous filament advanced composite isogrid. This is the first attempt to evaluate it in load bearing structure. A data base has been established by the design, fabrication and test of flat panels as wide columns. Correlation of the experimental results with theory, on a relative basis, is excellent. Inconsistency in manufacturing is clearly identified as the major reason for scatter in observed data, a problem which would not exist in a production environment. The results presented are a major step toward inspiring the necessary confidence in the use of this concept in airframe structure. Author (GRA)

N79-22214# Manchester Univ. (England). Dept. of Metallurgy.

MEASUREMENT OF THERMAL DIFFUSIVITY OF CARBON/CARBON FIBRE COMPOSITES FROM 20-3000 DEG C Interim Report, 30 Sep. 1977 - 29 Sep. 1978

Roy Taylor and Rob N. Procter Nov. 1978 23 p refs
(Grant AF-AFOSR-3449-77; AF Proj. 2308)
(AD-A064778; AFOSR-79-0065TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

Thermal diffusivity measurements from 500-2300K have been made on the following materials using the laser pulse method. (a) Two mutually perpendicular directions of a three dimensional carbon/carbon fibre composite, (b) Parallel and perpendicular directions of a unidimensional carbon/carbon fibre composite, (c) The matrix material used in fabricating the above composites. The use of a computer based digital data acquisition system significantly enhances the precision and accuracy of the diffusivity measurements. Author (GRA)

N79-22215# Rockwell International Corp., Columbus, Ohio. Aircraft Div.

EVALUATION OF COMPOSITE WING FOR XFV-12A AIRPLANE, APPENDIX C Final Report, Aug. - Sep. 1978

13 Oct. 1978 65 p
(Contract N62269-74-C-0577)
(AD-A063848; NADC-77183-30-APP-C) Avail: NTIS HC A04/MF A01 CSCL 11/4

This Appendix, prepared as a supplement to final report NADC-77183-30 dated December 1976, presents results of static and fatigue tests of a graphite/epoxy wing box structure designed and fabricated by the Columbus Aircraft Division (CAD) of Rockwell International Corporation under contract N62269-74-C-0577. These tests were conducted by the Navy at the Naval Air Development Center, Warminster, Pa. during the period August-September 1978. Static loads to 150% of design limit load for the critical carrier based landing condition were applied to the composite wing box structure followed by a two lifetime fatigue spectrum loading with no evidence of structural damage or deformation. Descriptions of the test setup, applied loadings, strain gage data, deflection transducer data, and comparisons of predicted vs recorded strain and deflection measurements are presented. Author (GRA)

N79-22216# Dyna East Corp., Wynnewood, Pa.

STATISTICAL ANALYSIS OF FATIGUE OF COMPOSITE MATERIALS Interim Technical Report, 1 Apr. 1977 - 31 Mar. 1978

Pei Chi Chou and A. S. D. Wang Jul. 1978 85 p refs
(Contract F33615-77-C-5039; AF Proj. 2307)
(AD-A064151; AFML-TR-78-96) Avail: NTIS HC A05/MF A01 CSCL 11/4

The objectives of the program are to study three basic hypotheses in fatigue of composite materials. These are: (1) cyclic loading degradates the matrix properties and thus lower the compression strength more than tension-strength; (2) the static strength and fatigue life have equal ranks; and (3) the residual strength may increase. Both analytical and experimental approaches are used. The results are not yet conclusive. A sudden-death model is proposed to measure the degration of residual strength. Three regimes of residual strength are distinguished, these are the increase of strength, weak degradation, and strong degradation. Author (GRA)

N79-22217# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

REPRESENTATION OF MATRIX/INTERFACE-CONTROLLED STRENGTH OF UNIDIRECTIONAL COMPOSITES Final Report, 1 May 1976 - 31 Dec. 1977

H. Thomas Hahn and J. Erikson Aug. 1978 38 p
(AF Proj. 2419)
(AD-A063796; AFML-TR-78-85) Avail: NTIS HC A03/MF A01 CSCL 11/4

The report presents a method of characterizing the matrix/interface-controlled strength, including scatter, of unidirectional composites under combined loading. The failure envelope is represented by a second order polynomial and the scatter is described by the strength vector whose magnitude has a Weibull distriubtion. The method is based on the assumption of failure originating at inherent cracks parallel to the fibers and holds promise as a means of accounting for the size effect

under combined loading. In addition, the energy release rate approach is discussed as a physical model and the appropriate data are presented. Author (GRA)

N79-22218# Aerospace Corp., El Segundo, Calif.
LASER IRRADIATION OF CARBON FIBERS AND COMPOSITES Final Report
J. Stephen Evangelides 25 Jan. 1979 79 p refs Prepared for SAMSO
(Contract F04701-78-C-0079)
(AD-A063783; TR-0079(4550-75)-1; SAMSO-TR-78-30) Avail: NTIS HC A05/MF A01 CSCL 11/4

The use of carbon-carbon composites as reentry vehicle nose tips has increased due to their unique thermochemical and thermostructural properties. One performance criterion of particular importance to the aerospace community is the ablation behavior. Since a large number of candidate composites is available, a preliminary screening test was sought which could select the most promising fibers and composites. Therefore, the objective of this program was to irradiate various carbon/graphite filaments, bulk pitch matrices, carbon-carbon composites and pyrolytic graphite to characterize mass loss and structural changes. The laser irradiation experiments have provided an insight into the microstructural mechanisms of ablation. They have shown that correlations exist between mass loss and material properties, that differences exist in mass loss characteristics between composite constituents, and that ablation testing results in similar correlations. It was concluded that laser irradiation of reentry nose tip materials can be used to investigate the behavior of carbonaceous materials in an ablation environment.
Author (GRA)

N79-22219# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
STRUCTURE, STABILITY AND TOUGHNESS OF (Co, Cr)-(Cr, Co)7 C3
L. Y. Lin, M. H. AbdelLatif, and A. Lawley Nov. 1978 21 p refs
(Contract N00014-76-C-0205)
(AD-A064747) Avail: NTIS HC A02/MF A01 CSCL 11/4

The substantial increase in efficiency of a gas turbine engine with increased inlet temperatures has led to the consideration of metal matrix composites for use as the blade material. In particular, in-situ composites, grown by directional solidification, consisting of high-strength fibers or plates in a ductile and tough matrix provide outstanding high temperature properties. This class of materials represents a major innovation in gas turbine technology for applications in aerospace, shipboard, and on land. Intrinsically, in-situ composites are stable at elevated temperatures, a characteristic derived from their solidification under near equilibrium conditions, coupled with the formation of low-energy interface boundaries. However, microstructural instability and attendant property degradation may occur as a result of prolonged high-temperature exposure, thermal cycling, or the presence of a thermal gradient. Since these reflect normal service conditions, it is necessary to assess composite integrity.
GRA

N79-22220# General Electric Co., Philadelphia, Pa. Environmental Systems Div.
CHEMICAL AND PHYSICAL ASPECTS OF MESOPHASE FORMATION DURING CARBON - CARBON PROCESSING Annual Report, 1 Dec. 1977 - 30 Nov. 1978
J. J. Gebhardt 8 Dec. 1978 29 p refs
(Contract F49620-78-C-0006; AF Proj. 2303)
(AD-A064785; AFOSR-79-0071TR) Avail: NTIS HC A03/MF A01 CSCL 11/4

Equipment designed around the use of a laboratory Instron test machine is described for making high pressure measurements of sound velocity and viscosity at elevated temperature. Sound velocity measurements were made in phenanthrene at temperatures between 393K and 562K and pressures between 0.1 and 101 MPa. A linear relation between the cube of sound velocity and pressure was observed. Velocity measurements were also made in coal tar pitch in the same temperature range at 0.1 MPA. Author (GRA)

N79-22221# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
EFFECT OF OXIDATION ON THE TOUGHNESS AND STRENGTH OF THE Co, Cr-(Cr, Co) SUB 7 C3 IN-SITU COMPOSITE
M. H. Abdel Latif and A. Lawley Jan. 1979 8 p refs
(Contract N00014-76-C-0205)
(AD-A064804) Avail: NTIS HC A02/MF A01 CSCL 11/4

Some preliminary observations on the oxidation response of Co,Cr-(Cr,Co)7C3 in air at 1121 C are presented. These include weight gain and subsequent room temperature strength, hardness and toughness. The composite shows superior oxidation resistance to several other in-situ composites by virtue of its high chromium content. Oxidation enhances toughness but leads to a decrease in hardness and strength. The toughness increase is associated with fiber coarsening. Author (GRA)

N79-22222# Douglas Aircraft Co., Inc., Long Beach, Calif.
TESTING FOR MECHANICAL PROPERTIES OF MONOLITHIC AND LAMINATED POLYCARBONATE MATERIALS. PART 2: TEST DATA Final Report, Jan. 1976 - Oct. 1978
F. E. Greene Oct. 1978 469 p refs
(Contract F33615-75-C-3105)
(AD-A064797; MDC-J6950-Pt-2; AFFDL-TR-77-96-Pt-2) Avail: NTIS HC A20/MF A01 CSCL 11/9

This report documents the test measurement and test calculations data, specimen photographs, and the material property program computer data outputs used for the development of mechanical properties data presented in Part 1 of this report.
Author (GRA)

N79-22223# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
THE ROLE OF THE INTERFACE ON THE MECHANICAL BEHAVIOR OF METAL MATRIX COMPOSITES Final Report
A. Lawley Jan. 1979 15 p refs
(Contract N00014-76-C-0205)
(AD-A065042) Avail: NTIS HC A02/MF A01 CSCL 11/4

The microstructural stability and mechanical behavior of the in-situ Co,Cr-(Cr,Co)7C3 composite and filamentary Ni-Mo and nichrome-tungsten composites have been characterized as a function of isothermal exposure and various regimes of thermal cycling. Properties examined were strength, toughness and resistance to fatigue crack propagation. Correlations were developed between microstructural change accompanying each mode of heat-treatment and the above properties. This provided the basis for the development of models for plastic flow and crack initiation/propagation in the two types of composite material which can account for the observed effect(s) of the heat-treatment imposed. Author (GRA)

N79-22224# Connecticut Univ., Storrs.
A STUDY OF THE FATIGUE BEHAVIOR OF FIBER REINFORCED COMPOSITES Final Report, 1 Mar. 1975 - 30 Jun. 1976
A. T. Dibenedetto and Gideon Salee Mar. 1977 111 p refs
(Contract DAAG46-75-C-0064; DA Proj. 1T1-62105-AH-84)
(AD-A065152; AMMRC-CTR-77-12) Avail: NTIS HC A06/MF A01 CSCL 11/4

The fatigue failure of graphite fiber reinforced nylon is influenced by both the technique of fabrication of the composite and environmental conditions. Compression molded materials exhibited an isothermal brittle fatigue failure through initiation and propagation of cracks. Injection molded materials were non-linear, exhibiting ductile flow prior to ultimate failure. It is postulated that localized flow at a crack tip caused thermal melting, leading to a thermally induced fatigue failure. This study indicated that processing characteristics such as fiber breakage, overlap and orientation strongly influence the fatigue endurance of the products. GRA

N79-22225# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
ELEVATED TEMPERATURE STABILITY OF A Co-Cr-C IN-SITU COMPOSITE
Y. Taniyama and A. Lawley Nov. 1978 24 p refs
(Contract N00014-76-C-0205)

(AD-A064853) Avail: NTIS HC A02/MF A01 CSCL 11/4

Monovariant eutectic alloys of Co-Cr-C offer potential in advanced gas turbine technology. Key to performance is stability of microstructure and hence strength integrity at elevated temperatures. To assess microstructural stability, composites of composition Co-41% Cr-2.4% C were subjected to isothermal exposures at homologous temperatures of 0.85, 0.89, and 0.92 respectively, for times up to 2500000 S. The composite consists of an aligned rod-like reinforcement of (Cr,Co)7C3 at Vf 0.3 in a cobalt-rich solid solution matrix. Transverse sections were examined as a function of (T,t) by a combination of optical and scanning electron microscopy and provided the basis for a detailed and quantitative evaluation of changes in rod density (number per unit area), rod spacing, spread of spacings, rod shape and shape spread. While the observations confirm good high-temperature stability, changes in microstructure occurred with an associated decrease in rod density. The faceted appearance of the carbide rods, characteristic of the as-grown condition, gave way to a more rounded appearance. Subtle manifestations of structural instability exist which are related to the irregular cross-sectional form of the rod carbides in the as-grown composite. Data have been analyzed in terms of the competing coarsening mechanisms of two-dimensional ripening, fault migration and fault migration plus annihilation. Author (GRA)

N79-22226# National Technical Information Service, Springfield, Va.

LAMINATES, PART 2. OTHER MATERIALS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1979

Diane M. Cavagnaro Mar. 1979 196 p Supersedes NTIS/PS-78/0203, NTIS/PS-77/0165 and NTIS/PS-76/0193 (NTIS/PS-79/0187/9; NTIS/PS-78/0203; NTIS/PS-77/0165; NTIS/PS-76/0193) Avail: NTIS HC $28.00 /MF $28.00 CSCL 11D

The bibliography cites studies of laminates other than plastic laminates. The majority of these studies cover laminates comprising a plastic, or reinforced plastic, and a glass or metal. Reports cover fabrication, performance, design, bonding, and physical and structural properties. GRA

N79-22227# Applied Engineering Resources, Inc., Santa Barbara, Calif.

TECHNOLOGY ASSESSMENT OF ADVANCED COMPOSITES, PHASE 1 Final Report, 1 Oct. 1977 - 31 Mar. 1978

Robert Kaiser Mar. 1978 155 p refs (PB-290325/0; NSF/PRA-7719647/1) Avail: NTIS HC A08/MF A01 CSCL 11D

The primary objective of Phase 1 was to develop the approach and basic data upon which a full technology assessment of advanced composite materials could be built. The emphasis in this project was on future use of composites for purposes other than transportation applications, such as construction and mining equipment and other structural items. However, the approach developed is applicable to the complete range of applications, and related issues. The approach combined two features related to methods and data: (1) taking appropriate portions of methodologies of analogous assessments already performed and adapting them to the advanced composite situation; and (2) performing the necessary analyses and projections starting from the available, extensive, and collected source data. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N79-22228 Northwestern Univ., Evanston, Ill.

ENERGY DISTRIBUTION AMONG PRODUCT STATES FOR REACTIVE PROCESSES Ph.D. Thesis

James Eugene Robin 1978 188 p

Avail: Univ. Microfilms Order No. 7907930

Twenty two dissociation reactions of polyatomic ions formed by dissociative electron attachment and by electron beam ionization are studied by considering several simple models for predicting the kinetic energy of separation of the fragments. An equivalence is drawn between the microcanonical ensemble exact count of states and the method of steepest descents applied to the canonical ensemble. A lifetime argument is proposed within the latter method for several models of the activated complex, and good agreement between model predictions for the entire range of molecular size and excess energy content is found. The method of steepest descents is applied to the simple potential scattering method to include product rotational energy in a statistical manner. Trends in the prediction of the vibrational energy distribution in the products are favorable, though the approach overcompensates for the previous neglect of rotations, in general. Dissert. Abstr.

N79-22229 Harvard Univ., Cambridge, Mass.

STRUCTURE AND INTERNAL DYNAMICS OF WEAKLY BOUND COMPLEXES FROM A CHEMICAL VIEWPOINT Ph.D. Thesis

Joseph Mark Steed 1979 203 p

Avail: Univ. Microfilms Order No. 7907707

The results of molecular beam electric resonance studies of several weakly bound complexes are reported. The interpretive emphasis is placed on the relationships between weak binding in these complexes and ordinary chemical binding. In particular, a donar-acceptor molecular orbital model of weak binding is shown qualitatively to be useful both in predicting structures and in interpreting derived results. Such a description emphasizes the chemical nature of weak binding as opposed to a more physical picture typically applied to van der Waals interactions. Dissert. Abstr.

N79-22230 Princeton Univ., N. J.

RESONANCE RAMAN STUDIES OF URANOCENE. 1. CARS STUDY OF CARBOXYHEMOGLOBIN, 2. ELIPTICALLY POLARIZED RAMAN SCATTERING, 3 Ph.D. Thesis

Richard Frederick Dallinger 1979 169 p

Avail: Univ. Microfilms Order No. 7907968

Resonance Raman spectra were taken of uranocene, in the vicinity of the ring-metal charge transfer transitions. The excitation profiles for the three bands are determined. An energy level diagram is constructed and the visible absorption bands are assigned according to polarization. Time-resolved coherent anti-Stokes Raman scattering spectra of carboxyhemoglobin were taken. There are no bands observed in the ranges expected for planar hemes. The iron atom moves out of the heme plane, where it resides in carboxyhemoglobin, toward its position in deoxyhemoglobin in a time short compared to the laser pulse width of 6 nanoseconds. This result is compared with other known kinetic parameters to give the current picture of heme ligation mechanisms. Equations are developed which describe the Raman process for which the incident laser excitation is elliptically polarized. Dissert. Abstr.

N79-22231 Ohio State Univ., Columbus.

STUDY OF THE FORMATION AND REACTIVITY OF ORGANIC CATIONS IN SOLUTION BY THE PULSE RADIOLYSIS METHOD Ph.D. Thesis

Ying Wang 1978 192 p

Avail: Univ. Microfilms Order No. 7908232

The formation mechanism of three arylcarbenium ions, the benzyl cation, the benzhydryl cation, and the trityl cation, in the irradiated 1,2-dichlorethane solution was studied. It was found that two kinetically distinguishable positive charged species were formed by the radiolysis of 1,2-dichloroethane. One is believed to be a parent radical cation or a radical cation resulting from the HCl elimination or both (if they are kinetically indistinguishable); the other is believed to be a chloronium ion resulting from the cleavage of C-Cl bond. Different precursor compounds selectively scavenge these two species and yield different carbenium ions. The reactivities of the benzyl and the benzhydryl cations with various alkenes were determined. The product stability principle and the principle of least nuclear motion, may qualitatively explain the observed effects. Dissert. Abstr.

N79-22232 Institute of Paper Chemistry, Appleton, Wis.
AN INVESTIGATION OF THE VIBRATIONAL SPECTRA OF GLUCOSE, GALACTOSE, AND MANNOSE Ph.D. Thesis
Henry Alden Wells, Jr. 1977 435 p
Avail: Univ. Microfilms Order No. 7907014

Vibrational spectra were obtained for the following compounds: alpha glucose, alpha glucose-1-d, alpha glucose-6, 6-d sub 2, alpha glucose-0-d sub 5, beta glucose, beta glucose-6, 6-d sub 2, beta glucose-0-sub 5, alpha galactose, beta galactose, alpha mannose, and beta mannose. Many of these spectra were better resolved than in previous reports due to the use of low sample temperatures. The data base was completed by the addition of several literature reports for other deuterated variations of these three sugars. Dissert. Abstr.

N79-22233 Illinois Univ. at Chicago Circle, Chicago.
PHOTOELECTRON STUDIES OF THE ELECTRONIC STRUCTURE AND TAUTOMERISM OF BIOLOGICAL PURINES AND PYRIMIDINES Ph.D. Thesis
Shiesen Peng 1978 139 p
Avail: Univ. Microfilms Order No. 7908414

Ultraviolet photoelectron spectroscopy was used to study electronic structure and tautomerism in purine, adenine and their methyl substituted derivatives. The spectroscopic results were compared to energy levels predicted by CNDO/2 and INDO molecular orbital calculations which give a good description of the highest occupied orbitals in these molecules. A comparison of spectra and results from molecular orbital calculations on purine, adenine and their 7- and 9-methyl substituted derivatives indicates that the N(7)H tautomeric form of purine is more stable than the N(9)H tautomeric form while the N(9)H tautomeric form of adenine is more stable than the N(7)H tautomeric form. The electronic structure and gas phase tautomerism of xanthine, hypoxanthine, quanine and their methyl substituted derivatives are also discussed. Dissert. Abstr.

N79-22234 Kansas State Univ., Manhattan.
DESIGN AND EVALUATION OF A FLUORINE COMBUSTION ELEMENTAL ANALYSIS APPARATUS Ph.D. Thesis
Christopher Duddard Rainey 1978 161 p
Avail: Univ. Microfilms Order No. 7906804

The development and investigation of a system of elemental analysis is reported. The apparatus required to develop such a system includes: (1) a high pressure fluorine dispensing system; (2) the combustion vessel itself; (3) a gas sampling system; and (4) a gas chromatograph capable of handling fluorine. Initial results indicated that the combustion products fell into two main classes. One class, such as carbon tetrafluoride and sulfur hexafluoride, was inert and non-reactive. The other class, typified by chlorine trifluoride and bromine pentafluoride, was highly reactive and corrosive. The technique of reactive gas chromatography played a vital role in solving the separation problem. Dissert. Abstr.

N79-22235* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD AND DEVICE FOR THE DETECTION OF PHENOL AND RELATED COMPOUNDS Patent
Julian G. Schiller (Pittsburgh Univ., Pa.) and Chung C. Liu, inventors (to NASA) (Pittsburgh Univ., Pa.) Issued 20 Mar. 1979 8 p Filed 25 Feb. 1977 Supersedes N77-18238 (15 - 09, p 1148) Sponsored by NASA
(NASA-Case-LEW-12513-1; US-Patent-4,145,255; US-Patent-Appl-SN-772167; US-Patent-Class-195-103.5R; US-Patent-Class-195-127; US-Patent-Class-204-1T; US-Patent-Class-2041-195B) Avail: US Patent and Trademark Office CSCL 07D

A method is described which permits the selective oxidation and potentiometric detection of phenol and related compounds in an electrochemical cell. An anode coated with a gel immobilized oxidative enzyme and a cathode are each placed in an electrolyte solution. The potential of the cell is measured by a potentiometer connected to the electrodes.

Official Gazette of the U. S. Patent and Trademark Office

N79-22236# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
CHEMICAL KINETICS OF HIGH TEMPERATURE GASES
1971 452 p refs Lecture held at Rhode-Saint-Genese, Belgium, 10-14 May 1971
(VKI-Lecture-Series-37) Avail: NTIS HC A20/MF A01

Theoretical models and experimental techniques used in the field of chemical kinetics are reviewed. Particular emphasis is placed on the coupling of chemical kinetics with fluid dynamics. For individual titles, see N79-22237 through N79-22243.

N79-22237# Naval Ordnance Lab., White Oak, Md.
INTRODUCTION TO BASIC THEORETICAL CONCEPTS. PART A: FUNDAMENTALS OF REACTING GASES, EQUILIBRIUM PROPERTIES
K. R. Enkenhus *In* Von Karman Inst. for Fluid Dyn. Chem. Kinet. of High Temp. Gases 1971 112 p refs (For primary document see N79-22236 13-25)
Avail: NTIS HC A20/MF A01

The problem of determining the equilibrium thermodynamic properties of a reacting gas mixture is considered. The principles of quantum mechanics are emphasized. Specific topics covered include: stationary states of elementary systems; atoms with multiple electrons; quantum mechanics of molecules; the equilibrium distribution of energies among particles-statistical mechanics; and calculation of the thermodynamic properties of a reacting gas mixture. J.M.S.

N79-22238# Naval Ordnance Lab., White Oak, Md.
INTRODUCTION TO BASIC THEORETICAL CONCEPTS. PART B: CHEMICAL REACTION RATES, NON-EQUILIBRIUM PHENOMENA
K. R. Enkenhus *In* Von Karman Inst. for Fluid Dyn. Chem. Kinet. of High Temp. Gases 1971 76 p refs (For primary document see N79-22236 13-25)
Avail: NTIS HC A20/MF A01

Various theoretical methods of predicting chemical reaction rates are explored. The interaction of particles with radiation, particle collisions, methods of calculating reaction rates, and relaxation of internal energy modes are the principle subjects discussed. J.M.S.

N79-22239# Los Alamos Scientific Lab., N. Mex.
EXPERIMENTAL TECHNIQUES (SIMULATION)
R. W. Getzinger *In* Von Karman Inst. for Fluid Dyn. Chem. Kinet. of High Temp. Gases 1971 39 p refs (For primary document see N79-22236 13-25)
Avail: NTIS HC A20/MF A01

Experimental techniques developed to study the stoichiometry and rate coefficients of all of the relevant elementary steps of a given overall reaction are considered. Basically, these techniques generate large quantities of atoms and free radicals on a time scale that is short compared to that for chemical relaxation in order to satisfactorily characterize rapid elementary reactions. Specific techniques discussed include: shock tubes; flash photolysis; electrical discharges; ballistic piston; and molecular beams. J.M.S.

N79-22240# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
EXPERIMENTAL TECHNIQUES (MEASUREMENT TECHNIQUES)
M. J. Lewis *In its* Chem. Kinet. of High Temp. Gases 1971 36 p refs (For primary document see N79-22236 13-25)
Avail: NTIS HC A20/MF A01

Techniques are described for monitoring the progress of a chemical reaction at high temperatures. The following are discussed: pressure gauges; laser schlieren and interferometry; electron beam scattering; and fluorescence and mass spectrometry. Emphasis is placed upon the basic principles of these techniques, the problems involved with their application, and their response, sensitivity, and accuracy. Author

N79-22241# Los Alamos Scientific Lab., N. Mex.
EXPERIMENTAL TECHNIQUES (SPECTROSCOPIC MEASUREMENTS)
R. W. Getzinger *In* Von Karman Inst. for Fluid Dyn. Chem. Kinet. of High Temp. Gases 1971 21 p refs (For primary document see N79-22236 13-25)
Avail: NTIS HC A20/MF A01

The application of spectroscopic techniques to the study of

chemical reaction rates is considered. Emphasis is placed on methods suitable for use in shock tube studies. Specific examples of the measurement of temperature and concentration profiles behind shock waves are given. J.M.S.

N79-22242# Southampton Univ. (England).
SOME ENGINEERING APPLICATIONS OF HIGH TEMPERATURE CHEMICAL KINETICS
K. N. C. Bray *In* Von Karman Inst. for Fluid Dyn. Chem. Kinet. of High Temp. Gases 1971 60 p refs (For primary document see N79-22236 13-25)
Avail: NTIS HC A20/MF A01

Engineering applications of high temperature, gas phase, chemical kinetics are reviewed. The equations for a chemically reacting gas flow are presented and briefly discussed. Other topics considered include: (1) the approach to equilibrium behind a normal shock wave and the departure from equilibrium in an expanding gas flow; (2) the flow field with chemical and ionization kinetics for a vehicle entering the Earth's atmosphere; and (3) the prediction of rates of production of pollutants in air breathing engines. J.M.S.

N79-22243# Cornell Univ., Ithaca, N. Y. Dept. of Chemistry.
TRENDS IN CHEMICAL KINETICS
S. H. Bauer *In* Von Karman Inst. for Fluid Dyn. Chem. Kinet. of High Temp. Gases 1971 76 p refs (For primary document see N79-22236 13-25)
Avail: NTIS HC A20/MF A01

The fundamental postulates of chemical kinetics are briefly summarized. Other topics covered include: potential energy surfaces; experiment versus theory; and expansion of experimental techniques. J.M.S.

N79-22244*# United Technologies Research Center, East Hartford, Conn.
LEAN STABILITY AUGMENTATION STUDY Final Report
John B. McVey and Jan B. Kennedy May 1979 185 p refs (Contract NAS3-20804)
(NASA-CR-159536; UTRC/R79-914104-18) Avail: NTIS HC A09/MF A01 CSCL 21B

An analytical conceptual design study and an experimental test program were conducted to investigate techniques and develop technology for improving the lean combustion limits of premixing, prevaporizing combustors applicable to gas turbine engine main burners. The use of hot gas pilots, catalyzed flameholder elements, and heat recirculation to augment lean stability limits was considered in the conceptual design study. Tests of flameholders embodying selected concepts were conducted at a pressure of 10 arm and over a range of entrance temperatures simulating conditions to be encountered during stratospheric cruise. The tests were performed using an axisymmetric flametube test rig having a nominal diameter of 10.2 cm. A total of sixteen test configurations were examined in which lean blowout limits, pollutant emission characteristics, and combustor performance were evaluated. The use of a piloted perforated plate flameholder employing a pilot fuel flow rate equivalent to 4 percent of the total fuel flow at a simulated cruise condition resulted in a lean blowout equivalence ratio of less than 0.25 with a design point (T sub zero = 600k, Phi = 0.6) NOx emission index of less than 1.0 g/kg. Author

N79-22245*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HIGH TEMPERATURE ELECTROLYTIC RECOVERY OF OXYGEN FROM GASEOUS EFFLUENTS FROM THE CARBO-CHLORINATION OF LUNAR ANORTHITE AND THE HYDROGENATION OF ILMENITE: A THEORETICAL STUDY
Thomas E. Erstfield (Lockheed Electronics, Inc.) and Richard J. Williams Apr. 1979 51 p refs
(NASA-TM-58214; JSC-14649) Avail: NTIS HC A04/MF A01 CSCL 07D

A thermodynamic analysis discusses the compositions of gaseous effluents from the reaction of carbon and chlorine and of hydrogen with lunar anorthite and ilmenite, respectively. The computations consider the effects of the indigenous volatiles on the solid/gas reactions and on the composition of the effluent gases. A theoretical parameterization of the high temperature electrolysis of such gases is given for several types of solid ceramic electrolytes, and the effect of oxygen removal on the effluents is computed. Potential chemical interactions between the gases and the ceramic electrolytes are analyzed and discussed. Author

N79-22246*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROL OF VOLUME RESISTIVITY IN INORGANIC ORGANIC SEPARATORS
Dean W. Sheibley and Michelle A. Manzo Apr. 1979 17 p refs
(NASA-TP-1439; E-9830) Avail: NTIS HC A02/MF A01 CSCL 07D

Control of resistivity in NASA inorganic-organic separators is achieved by incorporating small percentages of high surface area, fine particle silica with other ingredients in the separator coating. The volume resistivity is predictable from the surface area of filler particles in the coating. The approach is applied to two polymer- plasticizer -filler coating systems, where the filler content of each is below the generally acknowledged critical pigment volume concentration of the coating. Application of these coating systems to 0.0254 cm thick (10-mil) fuel cell grade asbestos sheet produces inexpensive, flexible, microporous separators that perform as well as the original inorganic-organic concept, the Astropower separator. Author

N79-22247# National Bureau of Standards, Washington, D. C. Center for Fire Research.
DETECTION OF FIRES IN ELECTRICAL CABLES
Richard Bukowski 1978 5 p Submitted for publication
Avail: NTIS HC A02/MF A01

The intelligent application of a systems design approach is necessary to provide the level of detection performance required at a cost consistent with the risk involved. Each and every type of detector and system available has applications where it and it alone is the best. The selection of detector and system arrangement must be determined through a logical decision process. This process should always involve a qualified fire protection engineer or system designer who is familiar with all types of detection equipment and the ways of which each works the best. Author

N79-22248# National Bureau of Standards, Washington, D. C. Center for Fire Research.
THE DETECTION OF FIRE INVOLVING ELECTRIC CABLE MATERIALS
Richard G. Bright 1978 20 p refs Submitted for publication
Avail: NTIS HC A02/MF A01

The dielectric insulation materials used for cable were studied. The materials used are: PVC, polyethylene, rubber, polychloroprene, and teflon. Pyrolytic degradation of these materials is due to elevated temperature resulting from an overload condition. Various fire detectors were evaluated as to their capability of early detection of the pyrolysis in these cable materials. It was concluded that for the early detection of the pyrolysis products from cable insulating materials fire sensors operating on the photoelectric principle are preferred. M.M.M.

N79-22249# National Bureau of Standards, Washington, D. C. Center for Fire Research.
STUDIES OF FLAMMABILITY TEST PROCEDURES FOR CURTAINS AND DRAPES Final Report
Donna E. Hopkins and John F. Krasny Mar. 1979 25 p refs Prepared for Coast Guard
(NBSIR-79-1596) Avail: NTIS HC A02/MF A01

The Intergovernmental Maritime Consultative Organization (IMCO) expressed the need of a simple, relevant flammability test method for the curtain and drapery fabrics used aboard ships. Two methods for measuring self-extinguishment of fabrics upon removal of the flame were compared. One was proposed by the United States' representative to IMCO, the other was an adaptation of a recently proposed method of the International Standards Organization (ISO). The effects of variations of the proposed test methods (changes in the ignition flame characteristics, bottom edge or surface ignition, and in the specimen suspension) were also investigated. In general, the relative ranking of the fabrics was not changed, though the individual afterflame

time and char length results were affected by some of these variables. The advantages and disadvantages of the two proposed test methods are discussed and an improved method is recommended. L.S.

N79-22250# University of Southern California, Los Angeles. Dept. of Chemistry.

WHITHER INORGANIC PHOTOCHEMISTRY. A PAROCHIAL VIEW

Arthur W. Adamson Jul. 1978 17 p refs

(Contracts N00014-76-C-0548; NSF CHE-77-05951)

(AD-A063482) Avail: NTIS HC A02/MF A01 CSCL 07/2

The main streams of development of the photochemistry of coordination compounds are summarized and related to current areas of major activity. Several are illustrated in terms of work in progress in the author's laboratory. The d3 system of Cr(III) complexes has become the paradigm one for the field, and detailed studies of emission lifetimes and of rates of primary photoproduct formation clarify the chemistry of the first doublet and quartet thermally equilibrated excited (thexi) states. New rules governing emission lifetimes are presented. Excited state absorption spectra and possible resonance Raman spectroscopy of thexi states are described for Rh(III) complexes. Results on the photochemistry of Co(III) ammines having a Co-S bond are given, and on the chemistry and photophysics of aqueous polymers of Pt(CN) 4(2-). Likely directions of development in the next decade are discussed. Existing and new model systems will be explored in increasing depth; there will be major advances in elucidating the reaction mechanisms of thexi states and on their spectroscopy and thermodynamics. Studies on solar energy conversion systems will continue, with some laboratory but no economic success.

Author (GRA)

N79-22251# Rockwell International Science Center, Thousand Oaks, Calif.

ELECTROCHEMICAL STUDIES OF ATMOSPHERIC CORROSION Final Report, 1 Apr. 1975 - 29 Dec. 1978

Florian B. Mansfeld Jan. 1979 141 p refs

(Contract N00014-75-C-0788)

(AD-A063922; SC5030.7FR) Avail: NTIS HC A07/MF A01 CSCL 11/8

Electrochemical studies of atmospheric corrosion phenomena have been performed over a 42 months period. The kinetics of corrosion reactions occurring under thin electrolyte layers 100-1000 microns have been studied for steel, zinc, Cu and AL by recording potentiodynamic polarization curves using a modified atmospheric corrosion monitor ACM. Normal Tafel behavior was observed, the limiting current for oxygen reduction increased linearly with inverse film thickness. Similar experiments in which corrosion kinetics were determined from polarization resistance measurements using the CORFIT computer program showed that with decreasing film thickness the corrosion reaction becomes charge transfer controlled. Laboratory and outdoor exposure tests have shown that corrosion rates increase drastically when the electrolyte layers become very thin during the drying out process at RH 100%. This phenomenon has been studied in detail by evaluating the effects of corrosion product chemistry, RH and SO2. A comparison of corrosion rates obtained under identical conditions in weight loss and electrochemical experiments has been carried out for steel and zinc and a function of RH and electrolyte concentration. The ACMS have been used extensively to monitor atmospheric corrosion behavior in outdoor exposure. In the final phase of this project surface an analyses have been carried out for 4130 steel and zinc which had been corroding under thin electrolyte layers. GRA

N79-22252# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

SOOTING CHARACTERISTICS OF LIQUID POOL DIFFUSION FLAMES M.S. Thesis

Kenneth W. VanTreuren Jul. 1978 110 p refs

(Contract F49620-78-C-0004)

(AD-A064111; MAE-T-1393; AFIT-C1-79-44T) Avail: NTIS HC A06/MF A01 CSCL 21/4

This investigation deals with a liquid fuel diffusion flame and examines the use of the smoke point test as a means of qualitatively measuring the ability of a fuel to produce soot relative to other fuels. Results indicate the necessity of controlling the initial conditions in order to obtain meaningful measurements. This thesis reports a new technique for the smoke point determination that has proved to be more accurate and reproduceable than previous methods. Recent studies indicate water addition in a premixed flame chemically suppresses soot formation. As a result, addition of water inside a diffusion flame is a likely direction to pursue. Both water in fuel emulsions and direct steam injection were used in the present investigation. The results indicate a dominant thermal effect and a possible secondary chemical effect of water on soot formation. Blending of various fuel types reveals the domination of an aromatic fuel over an aliphatic when determining a combined smoke point of the mixture. Applying this information to alternative hydrocarbon fuels, the oil shale and coal derived fuels, having a higher percentage of aromatics than conventional fuels, produce soot more readily than their petroleum derived counterparts. Testing of oil shale and conventional fuels supplied by the Air Force verifies this result. GRA

N79-22253# Wisconsin Univ. - Madison. Mathematics Research Center.

MATHEMATICAL THEORY OF LAMINAR COMBUSTION. 4: STEADY BURNING OF A LINEAR CONDENSATE

J. D. Buckmaster and G. S. S. Ludford Oct. 1978 23 p refs

(Contract DAAG29-75-C-0024)

(AD-A064038; MRC-TSR-1888) Avail: NTIS HC A02/MF A01 CSCL 21/2

We are concerned here with the deflagration of reactants that are produced by gasification at the surface of a solid or liquid. In particular, the influence of pressure on the gasification rate is examined under various conditions. In contrast to earlier treatments, the basic phenomena, including several unsuspected ones, are clearly uncovered by activation-energy asymptotics.

Author (GRA)

N79-22254# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.

ENERGY TRANSFER IN A 2 SIGMA (+) OH. 2: VIBRATIONAL

Russell K. Lengel and David R. Crosley Nov. 1978 73 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A064098; AD-E430160; ARBRL-TR-02118) Avail: NTIS HC A04/MF A01 CSCL 07/4

Vibrational energy transfer within the A state of OH and OD has been studied. A frequency doubled tunable dye laser excites individual N:, J: levels in v:=1 or 2, and the intensities of rotationally resolved fluorescence emitted in the presence of collision partners (helium, argon hydrogen, deuterium and nitrogen) furnishes state-to-state transfer rates. It is found that the transfer rates are strongly dependent on initial rotational level (decreasing as the rotational quantum number increases), that the final rotational state distributions are near thermal but hot, that isoenergetic transfer is small, and that the magnitudes for transfer 1 to 0, 2 to 0 are all similar. The rates themselves are large; for example, with nitrogen the cross section for 1 to 0 transfer with N-3 is 21 square Angstrom.' The results taken together, are supportive of a long-lived collision in which anisotropic attractive forces are of importance in the dynamics of the entrance channel. Author (GRA)

N79-22255# Wisconsin Univ. - Madison. Mathematics Research Center.

THE INFLUENCE OF THE LEWIS NUMBER ON THE DYNAMICS OF CHEMICALLY REACTING SYSTEMS

W. Ray and Stuart P. Hastings Oct. 1978 31 p refs

(Contract DAAG29-75-C-0024; Grant NSF ENG-76-17604)

(AD-A064037; MRC-TSR-1887) Avail: NTIS HC A03/MF A01 CSCL 07/4

The influence of Lewis number on stability and oscillations for stirred tanks, catalytic wires and gauzes, and catalyst particles is determined quantitatively. The mathematical structure is discussed and illustrated by example. Relaxation oscillations are found to be the natural asymptote to the bifurcating limit cycles as the Lewis number vanishes. Author (GRA)

N79-22256# Illinois Univ. at Urbana-Champaign. Roger Adams Lab.

INVESTIGATION OF THE MECHANISM OF THE UNIMOLEC-

ULAR AND THE ELECTRON DONOR CATALYZED THERMAL FRAGMENTATION OF SECONDARY PEROXY ESTERS: CHEMILUMINESCENCE OF 1-PHENYLETHYL PEROXY-ACETATE

Gary B. Shuster and Brian G. Dixon Jan. 1979 18 p refs
(Contract N00014-76-C-0745)
(AD-A063915) Avail: NTIS HC A02/MF A01 CSCL 07/2

The mechanism of the thermolysis of 1-phenylethyl peroxy-acetate was studied. In the absence of easily oxidized substrates this perester undergoes thermal fragmentation to yield quantitatively acetophenone and acetic acid. These products are formed by initial oxygen-oxygen bond homolysis followed by in cage hydrogen atom transfer. A small fraction of the so formed acetophenone is generated in an electronically excited state. In the presence of easily oxidized substrates the reaction of the perester is catalyzed and generates excited states by the chemically initiated electron-exchange luminescence (CIEEL) mechanism. An analogy with the catalyzed reaction is drawn to the excitation step of bacterio-luminescence. Author (GRA)

N79-22257# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE MEASUREMENT OF QUENCHING RATE CONSTANTS USING FLUORESCENCE EMISSION M.S. Thesis

Freddie Garcia, Jr. Dec. 1978 119 p refs
(AD-A064055; AFIT/GEP/PH/78-3) Avail: NTIS HC A06/MF A01 CSCL 07/2

A single counting technique is employed to measure the effective lifetime of excited NO2. These data are necessary for measurements of quenching rate constants of Ar, He and N2. A tuneable dye laser is used to raise the NO2 to an excited electronic level. The NO2 is held at a constant millitorr pressure while the foreign gas (Ar, He, N2) pressure is varied. The results are compared to another investigator. Author (GRA)

N79-22258# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.

MULTIANGULAR SCANNING ABSORPTION-EMISSION TECHNIQUES FOR THREE DIMENSIONAL COMBUSTION DIAGNOSTICS Annual Technical Report, 1 Sep. 1977 - 30 Aug. 1978

Robert Goulard Dec. 1978 34 p refs
(Grant AF-AFOSR-3439-77)
(AD-A064837; AFOSR-79-0056TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

Absorption techniques are being applied to three-dimensional combustion diagnostics. By using multiangular scanning, the traditional 'onion-peeling' method can be extended from axisymmetrial flows to arbitrary distributions of radicals and pollutants in the flow. Since Scattering 'point' techniques are limited by their very small cross section, such an extension would be a step improvement in sensitivity, down to low radical concentrations. Convolution Fourier transforms and iterative algorithms have already been proven in X-Ray absorption tomography and interferometric application. GRA

N79-22259# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

MULTIPLE IGNITION, NORMAL AND CATALYTIC COMBUSTION AND QUENCHING OF FUEL/AIR MIXTURES Interim Report, 1 Jun. 1977 - 31 May 1978

F. V. Bracco, H. S. Homan, W. A. Sirignano, and D. A. Santavicca Nov. 1978 24 p
(Grant AF-AFOSR-3052-76)
(AD-A064560; AFOSR-79-0005TR) Avail: NTIS HC A02/MF A01 CSCL 01/2

Ignition of a quiescent propane/air mixture by a stationary, hot, inert particle has been modeled. The tentative conclusion from the model is that an abraded aluminum particle must have a diameter greater than 800 microns to ignite a stoichiometric propane/air mixture. Experimental data show that a burning aluminum particle must be initially larger than 20-40 microns in diameter to ignite a stoichiometric methane/air mixture. Lean combustion of propane in platinum/alumina/cordierite catalysts has been studied at atmospheric pressure and gas velocities of 5-30 m/s. Measurements of substrate temperature and gas composition, pressure and temperature inside and downstream of the catalyst have been made. The dependences of substrate temperature, gas temperature, and gas composition on inlet temperature, reference velocity, and equivalence ratio have been investigated. Homogeneous reactions in the exhaust are observed only at the higher equivalence rations. Broader interpretation of the variation in exhaust composition with inlet conditions awaits completion of the development of the numerical model. Author (GRA)

N79-22260# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.

INVESTIGATIONS OF TURBULENT COMBUSTION Interim Report, 1 Aug. 1977 - 1 Aug. 1978

Norman A. Chigier and Andrew J. Yule Sep. 1978 9 p refs
(Grant AF-AFOSR-3414-77; AF Proj. 2308)
(AD-A064822; AFOSR-79-0053TR) Avail: NTIS HC A02/MF A01 CSCL 21/4

The aim of the research is to increase fundamental understanding of turbulent combustion in gas diffusion and spray flows related to propulsion systems; with particular emphasis on the roles of large eddies (coherent structures) in the turbulence. It is described how this objective requires the development of high resolution measurement techniques. Techniques are described for the measurement of particule size and velocity by laser anemometer, temperature by computer interfaced thermocouples and flame ionization by ionization probes. The initial results of the investigation are described for the two major areas; axisymmetric diffusion flows and fuel sprays. The importance of the initial, near field, region of the diffusion flame is described with emphasis on the influences of heat release anemometry, shows the importance of being able to measure gas velocity, particle velocity and particle size, simultaneously. This permits derivation of temporally averaged size distributions and turbulence-droplet interaction. Author (GRA)

N79-22261# Vermont Univ., Burlington. Dept. of Chemistry.

NEW HIGHLY CONDUCTING COORDINATION COMPOUNDS

D. B. Brown, K. Carneiro, P. Day, B. Hoffman, H. J. Keller, W. A. Little, A. E. Underhill, and J. M. Williams 17 Jan. 1979 11 p Submitted for publication
(Contract N00014-75-C-0756)
(AD-A064735; TR-11) Avail: NTIS HC A02/MF A01 CSCL 07/3

Structural features of coordination compounds which lead to high electrical conductivity are examined. Certain features are shown to be necessary for high conductivity, and suggestions are made concerning future synthetic efforts required in the search for molecular metals. Author (GRA)

N79-22262# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.

STUDY OF THE MAGNETIC FIELD DEPENDENCE OF THE MOLECULAR Ni(CO)4 FORMATION RATE Annual Research Report, 1 Oct. 1977 - 30 Sep. 1978

M. S. Dresselhaus 20 Dec. 1978 29 p refs
(Grant AF-AFOSR-3130-77; AF Proj. 2301)
(AD-A064807; AFOSR-79-0076TR; Rept-2301) Avail: NTIS HC A03/MF A01 CSCL 07/4

Initial work on the dependence of the nickel carbonylation rate on time, temperature and magnetic field has been completed and a manuscript describing this work in detail has been accepted for publication. Our current effort is in the study of the magnetic phase dependence of chemical activity (the Hedvall Effect). The nickel carbonylation reaction offers an ideal system for the study of this effect. One of the advantages of this system is the availability of Ni(1-x) Cu(x) alloys over the entire composition range $0 < x < 1$, thereby making accessible a wide range of Curie temperatures. Our preliminary results on this system show that the ferromagnetic to paramagnetic transition leads to a large change in the activation energy for the carbonylation reaction. Auger measurements confirm that the chemical reaction emphasizes the surface Ni atoms while the activation energy emphasizes the bulk Ni. Author (GRA)

N79-22263# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

PURE SULFUR DISCHARGES AND ASSOCIATED SPECTRA M.S. Thesis

Drew A. Peterson Oct. 1978 58 p refs
(AD-A064762; AFIT/GEP/PH/78D-10) Avail: NTIS HC A04/MF A01 CSCL 07/2

Stable, glow discharges in pure sulfur and He-sulfur were achieved for the first time, at operating temperatures between 0C and 250C. This result indicates that S8 is broken directly into S2 and means that temperatures much less than 600C can be used. The S2 (B-X) band emission is observed in great detail, and through analysis of these spectra the ground electronic state constants have been determined to the fourth order. GRA

N79-22264# National Standard Reference Data System.
EPA/NIH MASS SPECTRAL DATA BASE (1978). MOLECULAR WEIGHTS AND INDEXES
G. W. A. Milne Dec. 1978 4654 p Prepared in cooperation with Environ. Protection Agency, Washington, D. C. and the Natl. Heart Lung and Blood Inst., Bethesda, Md.
(PB-290661/8; NSRDS-NBS-63; LC-78-606175) Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

A collection of 25,556 verified mass spectra of Individual substances compiled from the EPA/NIH mass spectra file is presented. The spectra are given in bar graph format over the full mass range. Each spectrum is accompanied by a Chemical Abstracts Index substance name, molecular formula, molecular weight, structural formula, and Chemical Abstracts Service Registry Number. GRA

N79-22265# National Bureau of Standards, Washington, D. C. Center for Materials Science.
AN ALGORITHM AND BASIC COMPUTER PROGRAM FOR CALCULATING SIMPLE COAL GASIFICATION EQUILIBRIA
William S. Horton Aug. 1978 81 p refs
(PB-291241/8; NBSIR-78-1509) Avail: NTIS HC A05/MF A01 CSCL 07D

Calculation of the equilibrium composition for the gases CH4, CO, CO2, H2, and H2O is treated by minimizing the Gibbs energy, G. Minimization is constrained by the conservation of chemical elements. With the use of Lagrangian multipliers, the minimum is found by setting the partial derivatives of G with respect to the amount of each substance equal to zero. The resulting non-linear equations are solved iteratively by the Newton-Raphson method. This algorithm is implemented with an interactive computer program written in the BASIC language and named COLGAS. The aim of this work was to provide people who test materials in coal-gasification-like atmospheres an easy way to obtain the equilibrium composition of their gas mixtures. GRA

N79-22266# National Bureau of Standards, Washington, D. C. Office of Standard Reference Data.
SELECTED TABLES OF ATOMIC SPECTRA. A-ATOMIC ENERGY LEVELS, 2ND EDITION: B: MULTIPLET TABLES, O VI, O VII, O VIII
Charlotte E. Moore Jan. 1979 35 p refs
(PB-291914/0; NSRDS-NBS-3-SECT-8; LC-64-60074) Avail: NTIS HC A03/MF A01 CSCL 07D

The eighth section of a series being prepared in response to the need for a current revision of two sets of the author's tables containing data on atomic spectra as derived from analyses of optical spectra is presented. As in the previous Sections, Part A contains the atomic energy levels and Part B the multiplet tables. Section 8 includes these data for O 6, O 7, and O 8, thereby completing the spectra of oxygen. The form of presentation is described in detail in the text to Section 1. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-22267 State Univ. of New York at Albany.
THE ELECTRONIC STRUCTURE OF STRONGLY SCATTERING LIQUID AND AMORPHOUS METALS IN THE MUFFIN-TIN MODEL Ph.D. Thesis
Vijay Awadesh Singh 1978 125 p
Avail: Univ. Microfilms Order No. 7907223

The formalism of the muffin-tin model in liquid and amorphous metals is developed. An expression for the density of states is derived. Errors and shortcomings in previously attempted derivatives are pointed out. Calculations based on this derivation are presented. These calculations are for a one phase-shift model. They are designed to determine the range of validity of the various approximation schemes. The applications of the approximation schemes to two model systems discussed are: electrons in a one-dimensional correlated liquid metal and magnons in an amorphous Heisenberg ferromagnet. For these model systems computer based results are available. Dissert. Abstr.

N79-22268 Ohio State Univ., Columbus.
THE EFFECTS OF TEMPERATURE AND DISSOLVED OXYGEN ON THE STRESS CORROSION CRACKING SUSCEPTIBILITY OF TYPE 304 STAINLESS STEEL IN HIGH TEMPERATURE, HIGH PURITY WATER Ph.D. Thesis
Gary Arthur Welch 1978 349 p
Avail: Univ. Microfilms Order No. 7908234

Quench annealed Type 304 stainless cracked transgranularly at all concentrations tested at temperatures of 150, 200, 250, and 290 C. Increasing the dissolved oxygen concentration increases the crack propagation rates of specimens undergoing intergranular stress corrosion cracking. Increasing the test temperature increases the crack propagation rates. Dissert. Abstr.

N79-22269 Pennsylvania State Univ., University Park.
PREFERENTIAL REMOVAL OF Co FROM A Co-Pt ALLOY BY HCl AT 700 TO 1000 DEG C Ph.D. Thesis
Yoon Sam Kim 1978 207 p
Avail: Univ. Microfilms Order No. 7909091

The reaction of HCl with Co-10 a/o Pt alloy at 700 to 1,000 C was examined with the purpose of finding a model system for the study of the surface instability and mass transport associated with preferential removal processes. For the Co-rich portion of the Co-Pt alloy system a high rate of vaporization of the base metal (Co) occurs accompanied by profuse surface roughening, the reaction product is a volatile cobalt chloride, and the geometry of the porout structure varies with the HCl content in the gas mixture and with the temperature. Kinetic data obtained by measuring weight change established that the reaction proceeds at a linear rate for a significant period during which a well-defined porous structure forms and grows. The resulting Pt-rich porous reaction zone was studied by optical microscopy, scanning electron microscopy, ion scattering spectroscopy, and X-ray diffraction. Dissert. Abstr.

N79-22270 Michigan Univ., Ann Arbor.
STUDY OF LIQUID FILMS, FINGERS AND DROPLET MOTION FOR STEAM TURBINE BLADING EROSION PROBLEM Ph.D. Thesis
Wontaik Kim 1978 390 p
Avail: Univ. Microfilms Order No. 7907106

Large steam turbine blading erosion was investigated experimentally. High-speed cinematography and still photography were used to visualize the pertinent phenonmena and measure the important parameters. Also electrical conductivity microgages were used to measure liquid film thickness. Three film flow regimes were delineated; rivulet, wavy-film and an entrainment regime. Critical conditions for rivulet flow were obtained experimentally. Film wave characteristics were measured, showing waviness. These wavelets were either two-dimensional or three-dimensional depending on the flow conditions. For the entrainment regime, a correlation was found based on the film thickness measurements. This correlation explained horizontal film flow data, but not vertical passage data. Dissert. Abstr.

N79-22271* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROCESS FOR MAKING A HIGH TOUGHNESS-HIGH STRENGTH ION ALLOY Patent
Joseph R. Stephens and Walter R. Witzke, inventors (to NASA) Issued 27 Mar. 1979 4 p Filed 13 Dec. 1977 Supersedes N78-22205 (16 - 13, p 1681) Division of US Patent Appl. SN-803822, filed 6 Jun. 1977
(NASA-Case-LEW-12542-2; US-Patent-4,146,409; US-Patent-Appl-SN-860405; US-Patent-Class-148-2;

US-Patent-Class-148-12F; US-Patent-Class-148-12.4; US-Patent-Appl-SN-803822) Avail: US Patent and Trademark Office

A steel alloy is produced by a process which includes using cold rolling at room temperature and subsequent heat treatment at temperatures ranging from 500 C to 650 C. The resulting alloys exhibits excellent strength and toughness characteristics at cryogenic temperatures. This alloy consists essentially of about 10 to 16 percent by weight nickel, to about 1.0 percent by weight aluminum, and 0 to about 3 percent by weight of at least one of the following additional elements: copper, lanthanum, niobium, tantalum, titanium, vanadium, yttrium, zirconium and the rare earth metals, with the balance being essentially iron. The improved alloy possesses a fracture toughness ranging from 200 to 230 ksi sq in. and yield strengths up to 230 ksi.

Official Gazette of the U.S. Patent and Trademark Office

N79-22272# Royal Aircraft Establishment, Farnborough (England).

THE DEVELOPMENT OF INTERNAL STRESS IN ALPHA TITANIUM COLD WORKED IN TENSION

J. Charrier and J. deFouquet Nov. 1978 14 p refs Transl. into ENGLISH from Mater. Sci. Eng. (Netherlands), v. 34, no. 1, 1978 p 91-96

(RAE-Lib-Trans-1994; BR67148) Avail: NTIS HC A02/MF A01

The internal stress in commercial titanium cold worked under tension between 133 and 673 K was determined by relaxation tests. At low temperature, this stress varies much more rapidly than does the shear modulus. Studies carried out on samples with different grain sizes show that the hardening observed between 133 and 293 K has an intergranular origin and can be attributed to the formation of hydrides, with the most probable hardening mechanism being of the Orowan type. Author

N79-22273*# Iowa Univ., Iowa City. Div. of Materials Engineering.

EFFECT OF MISALIGNMENT ON MECHANICAL BEHAVIOR OF METALS IN CREEP Semiannual Status Report, 1 Nov. 1978 - 30 Apr. 1979

Han C. Wu 30 Apr. 1979 6 p refs

(Contract NsG-1499)

(NASA-CR-158489) Avail: NTIS HC A02/MF A01 CSCL 11F

Application of the endochronic theory of viscoplasticity to creep, creep recovery, and stress relaxation at the small strain and short time range produced the following results: (1) The governing constitutive equations for constant-strain-rate stress-strain behavior, creep, creep recovery, and stress relaxation were derived by imposing appropriate constraints on the general constitutive equation of the endochronic theory. (2) A set of material constants was found which correlate strain-hardening, creep, creep recovery, and stress relaxation. (3) The theory predicts with reasonable accuracy the creep and creep recovery behaviors at short time. (4) The initial strain history prior to the creep stage affects the subsequent creep significantly. (5) A critical stress was established for creep recovery. A computer program, written for the misalignment problem is reported. A.R.H.

N79-22274*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE FRICTION AND WEAR OF METALS AND BINARY ALLOYS IN CONTACT WITH AN ABRASIVE GRIT OF SINGLE-CRYSTAL SILICON CARBIDE

Kazuhisa Miyoshi and Donald H. Buckley 1979 28 p refs Proposed for presentation at the Joint Lubrication Conf., Dayton, Ohio, 16-18 Oct. 1979; cosponsored by Am. Soc. of Lubrication Engr. and ASME

(NASA-TM-79131; E-9973) Avail: NTIS HC A03/MF A01 CSCL 11F

Sliding friction experiments were conducted with various metals and iron-base binary alloys (alloying elements Ti, Cr, Mn, Ni, Rh and W) in contact with single crystal silicon carbide riders. Results indicate that the friction force in the plowing of metal and the groove height (corresponding to the wear volume of the groove) decrease linearly as the shear strength of the bulk metal increases. The coefficient of friction and groove height generally decrease, and the contact pressure increases with an increase in solute content of binary alloys. There appears to be very good correlation of the solute to iron atomic ratio with the decreasing rate of change of coefficient of friction, the decreasing rate of change of groove height and the increasing rate of change of contact pressure with increasing solute content. These rates of change increase as the solute to iron atomic radius ratio increases or decreases from unity. Author

N79-22275# Aeronautical Research Labs., Melbourne (Australia).

THE FATIGUE BEHAVIOR OF CIRCUMFERENTIALLY NOTCHED ALUMINIUM ALLOY SPECIMENS AS AFFECTED BY NOTCHING TOOL DWELL TIME

J. Y. Mann and F. G. Harris Aug. 1978 38 p refs

(ARL/Struc-Note-447; AR-001-293) Avail: NTIS HC A03/MF A01

Rotating cantilever fatigue tests were carried out on V-notched specimens of DTD683 aluminum alloy having K sub t values of 1.20, 1.45, 2.35. The respective notch radii were r.7, 2.0, 0.46 and 0.01 mm. In all cases the notches were plunge-cut machined in a lathe using carbide tip form tools and tool dwell times of zero and 200 revolutions before tool withdrawal from the finished notch. Tool dwell times of 200 revolutions resulted in signifcantly greater fatigue lives than zero dwell times for specimens of low K sub t (1.45 and 1.2). However, the fatigue tests results for specimens of higher K sub t (4.35 and 2.35) did not indicate any significant effects of notching tool dwell times. The use of different form tools for the notch of K sub t = 1.2 resulted in significantly different fatigue lives for specimens machined with 200 revolutions dwell time, but not for those machined with zero dwell time. No correlation was established between tool dwell times and the hardness, surface residual stresses and surface finish of the notches of K sub t = 1.2 to explain the differences in fatigue lives. However, the horizontal forces measured during the machining of the two notches of high K sub t were less than half those measured during the machining of the notches of low K sub t. Author

N79-22276*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

METALLURGICAL ANALYSIS OF SKYLAB M552 AND M557 SAMPLES Final Report

D. J. Larson, Jr. Dec. 1978 50 p refs

(Contract NAS8-28728)

(NASA-CR-161207; RE-565) Avail: NTIS HC A03/MF A01 CSCL 11F

The anomalous microstructures on the basis of phase equilibria, liquid/liquid phase separation, and liquid/solid segregation for the Skylab M557 and M552 flight samples were studied. All of the unknown diffraction spectra have been identified. The previously unknown crystal structure of the Zn3Sb2 phase the M577B Experiment was determined. Previously unreported effects due to the near-absence of the hydrostatic pressure head are documented for the M557C samples. Author

N79-22277# Utah Univ., Salt Lake City. Dept. of Chemistry.

RATES OF RAPID CHEMICAL REACTIONS Final Technical Report, 1 Feb. 1977 - 30 Nov. 1978

Edward M. Eyring 22 Jan. 1979 31 p refs

(Grant AF-AFOSR-3255-77; AF Proj. 2303)

(AD-A064763; AFOSR-79-0088TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

A rate and mechanism study of the corrosion of titanium metal by a hot perfluoropolyether lubricant has been carried out by a laser beam reflectance technique. A Fourier transform photoacoustic spectroscopy (FTPAS) technique has been developed that is potentially capable of producing absorption spectra of opaque surfaces at infrared wavelengths. FTPAS was not found suitable for studying corrosion of titanium because of thermal problems with the piezoelectric detector. Some homogeneous solution kinetic studies of reactions in water, acetonitrile and methanol were carried out also. Author (GRA)

N79-22278# Army Inst. of Dental Research, Washington, D.C.

ELECTROCHEMICAL BEHAVIOR OF GOLD ALLOYS

Eugene F. Huget, Stanley G. Vermilyea, Faris A. Modawar, and Laszlo B. deSimon 10 Jan. 1979 16 p refs

(AD-A064705) Avail: NTIS HC A02/MF A01 CSCL 11/6

Reactions resulting from polarization of five dental golds were studied. Test materials included an ADA certified type 3 alloy (Oro B-2) three 'economy' alloys (midas, Neycast and Minigold) and a high-fusing alloy (Olympia). The solvent was dilute lactated Ringer's solution ((C1-)approx. 24 m Eq/L). Anodic scans over potentials of -0.1 to -1.9 V vs SCE defined the active, passive the transpassive ranges of the alloys. Anodic polarization curves gave values for primary passive potential (Epp) and critical current density (Ic). Reduction phenomena were observed with cathodic scans over potentials of -1.9 to -0.1 V vs SCE. Intersection of anodic and cathodic curves delineated corrosion potential (Ecorr) and corrosion current density (Icorr). Potentials required to elicit a noble to active transition ranged from -.020 V for Neycast to -.093 V for Olympia. Analysis of electrochemical profiles revealed that at a chloride ion concentration comparable to that of human saliva, only Oro B-2 and Olympia exhibited the ability to passivate spontaneously. GRA

N79-22279# Illinois Univ. at Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.
HYDROGEN RELATED FAILURE MECHANISMS IN METALS
H. K. Birnbaum Dec. 1978 39 p refs
(Contract N00014-75-C-1012; Grant NSF DMR-78-24219)
(AD-A064854) Avail: NTIS HC A03/MF A01 CSCL 11/6

The literature pertaining to hydrogen related failure of metals is reviewed. Emphasis is placed on those experiments which relate directly to the failure mechanisms. The possible failure mechanisms are discussed and evaluated. Author (GRA)

N79-22280# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
THE DEVELOPMENT OF ULTRAFINE, SUPERPLASTIC STRUCTURES IN WHITE CAST IRONS
J. Wadsworth, L. E. Eiselstein, and O. D. Sherby Nov. 1978 32 p refs
(Contract N00014-75-C-0662)
(AD-A065073) Avail: NTIS HC A03/MF A01 CSCL 11/6

White case irons are not normally considered malleable. Recent work at Stanford, however, has demonstrated that these materials can in fact be hot forged, hot rolled and warm rolled. Further, such a series of thermomechanical treatments refines the as-cast structure so as to impart unusual and highly beneficial properties to the cast irons. In particular, the worked, white cast irons are found to be superplastic and there is a great improvement in room temperature properties. This processing procedure may therefore have significant technological applications. Author (GRA)

N79-22281# Electrochemical Technology Corp., Seattle, Wash.
FORMATION OF SALT FILMS DURING PASSIVATION OF IRON Interim Report, Mar. 1977 - Feb. 1978
Theodore R. Beck Dec. 1978 36 p refs
(Contract N00014-76-C-0495)
(AD-A063869) Avail: NTIS HC A03/MF A01 CSCL 11/6

Pure iron in the form of a shielded electrode facing upward was anodically polarized in hydrochloric, perchloric, and sulfuric acid solutions. Ferrous salt films formed in all three electrolytes at potentials and current densities above threshold values determined by mass transport. In perchloric and sulfuric acids, oxide passivation occurred underneath the salt film at potentials above the passivation potential. Analysis of kinetic and transport conditions under and within these salt films indicated that salt films are necessary precursors to oxide passivation in perchloric and sulfuric acid solutions. Oscillatory phenomena during passivation of iron can be explained by formation and dissolution of salt films coupled to pH changes under the salt film due to electrolytic migration. Author (GRA)

N79-22282# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
THE STUDY OF ALLOY SURFACES BY PLASMON EXCITATION Final Report, 1 Oct. 1975 - 31 Aug. 1978
W. D. Robertson and Arvid Herzenberg 14 Dec. 1978 68 p refs
(Contract N00014-76-C-0284)
(AD-A064089) Avail: NTIS HC A04/MF A01 CSCL 11/6

The surface plasmon dispersion relation for the (100) surface plane of aluminum has been measured by electron energy loss spectroscopy at glancing incidence, which completely suppresses the volume plasmon and minimizes multiple scattering. The dispersion relationship compares favorably with the only other measurement (made by a different technique, ILEED) on a well characterized single crystal surface. The results of the two independent measurements disagree substantially with all of the numerous dispersion relationships which are computed for different models of the surface charge density profile and which employ different computational approximations. However, the negative sign of the linear coefficient(-1.9), which is related to the density fluctuation of surface plasmons, is established and it may be interpreted to mean that the maximum in the surface charge fluctuation occurs inside the metal, rather than symmetrically about the surface plane. An appendix describes the effect of adsorbed oxygen on the energy loss spectra obtained from a clean surface. The surface plasmon peak at 10.3 eV is displaced by a new peak at 7.5 eV as oxygen exposure (torr-seconds) is increased. At large exposure of oxygen a broad peak appears at 20.6 eV. Plasmon dispersion was measured during oxygen exposure and it was found to be constant until the 10.3 eV plasmon peak disappears from the spectrum. GRA

N79-22283# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
Ti/Al DESIGN/COST TRADE-OFF ANALYSIS Final Report, 12 Sep. 1977 - 12 Mar. 1978
J. Holowach and T. K. Redden Oct. 1978 126 p refs
(Contract F33615-77-C-2066)
(AD-A064693; R78AEG534; AFAPL-TR-78-74) Avail: NTIS HC A07/MF A01 CSCL 21/5

A new class of alloys based on intermetallic compounds in the titanium aluminum system has shown the potential for application in the temperature range of 1000-1700 F. This program was undertaken to investigate the type of application and payoff that would result. Two titanium aluminum alloys were looked at, the Ti3Al (alpha two) and TiAl (gama). The use of Ti3Al was restricted to static components, whereas TiAl was limited to dynamic components. The dynamic application selected was a compressor and turbine blade. The static application was a mixing duct and exhaust duct liner. Cost of the selected titanium aluminides components was compared with the current cost of the nickel-base-superalloy components. The results show a cost increase for all the components. A detailed structural analysis of the four components shows the substitution would lead to longer life components. This substitution would result in not only a weight reduction in the engines, but a reduced fuel load and structure weight for a similar mission with the same bomb load, avionics, and other fixed equipment. An estimated $41.6 million dollars cost saving would result based on 240 aircraft for 20 years. Author (GRA)

N79-22284# Polytechnic Inst. of New York, Brooklyn.
FATIGUE CRACK NUCLEATION AND PROPAGATION IN ALPHA-BETA TITANIUM ALLOY Final Report
Harold Margolin and Yousef Saleh 30 Nov. 1978 15 p refs (Grant AF-AFOSR-2774-75)
(AD-A064661; AFOSR-79-0031TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

Observations have been made of crack path behavior of alpha-beta Titanium alloys on the surface and in interiors. The fracture surface for an alpha(Ti-0.4Mn) a beta(Ti-10.2Mn), and an alpha-beta alloy (Ti-5.2Mn), have been examined, TEM examiniation of alpha and beta alloys carried out and a study of slip line reversal during load reversal was made. Surface cracking occurs along alpha-beta interfaces and these cracks and joined by link-up. In the interior the crack proceeds along the lines of easiest slip with the result that cracks do not necessarily follow interfaces. The concentration of the crack path in alpha or along alpha-beta interfaces is attributed to higher strain in these regions. Striations are found to be more prominent in beta than in alpha and this is attributed to the higher strain hardening of the alpha phase. Hardening in alpha was attributed to an increase in dislocation density and interaction between twins and dislocations. It was not possible to ascertain whether softening in beta was due to an increase in dislocation density, a decrease in density of the structure giving rise to streaking on diffraction patterns

or both. Slip line reversal during reverse straining was found to occur preferentially at grain boundaries. GRA

N79-22285# American Univ., Washington, D. C. Dept. of Chemistry.
ON THE MECHANISM OF PITTING OF ALUMINUM Technical Progress Report
Trung Hung Nguye and R. T. Foley Jan. 1979 33 p refs
(Contract N00014-75-C-0799)
(AD-A064398; TR-9) Avail: NTIS HC A03/MF A01 CSCL 11/6

The Engell-Stolica potentiostatic method has been used for the kinetic study of the mechanism of pitting initiation of Al 1199. A statistical treatment of induction time has been developed in order to get meaningful data. Pitting initiation has been found to be potential-independent and the linear increase in the induction time for pitting with the increase of the potential applied in the passive range is due to the growth of the oxide film layer on the Al surface. The value of the critical potential obtained by extrapolation of the induction time vs potential plot to a zero induction time correlates with the value given in the literature. The trend toward a decrease in the kinetic order of the pitting reaction with an increase in the pH value of the aggressive solution has been confirmed. The independency of the kinetic order on the electrode potential of the solution indicates that the pitting initiation is controlled by a chemical process with the formation of an intermediate complex and therefore, is consistent with the 'complex ion theory' of corrosion.
Author (GRA)

N79-22286# Textron Bell Helicopter, Ft. Worth, Tex.
EVALUATION OF NON-CHROMATED ETCH FOR ALUMINUM ALLOYS, P-ETCH Quarterly Technical Report, 27 Sep. - 30 Dec. 1978
30 Nov. 1978 7 p refs
(Contract DAAK10-78-C-0398)
(AD-A064373; BHT-699-099-104; QTR-1) Avail: NTIS HC A02/MF A01 CSCL 13/8

The purpose of the work performed under this program is to evaluate the new chromate free etchant developed by US Army (ARRADCOM) for use in the preparation of aluminum alloys for adhesive bonding. The objective of the program is to generate data which will determine the suitability of the etchant for production use. It will establish the operational control procedures necessary for scale-up to production size and the impact of the solution on existing state-of-the-art waste disposal techniques will be studied. The surfaces produced will be studied to establish their chemical and physical nature. Selected adhesives will be used to explore the effects of solution concentration limits, solution life and storage time prior to bonding, as well as resistance to water immersion, high humidity, salt spray, heat, and cold, and immersion in fuel, lubricating oil and hydraulic fluid. In each case where applicable, panels prepared by the standard FPL etch treatment will be used as controls. The P-Etch will be used as a pretreatment prior to chromic acid and phosphoric acid anodize, and the resultant anodic treated surfaces will be tested for bondability and durability of the bonded joints. GRA

N79-22287# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
THE DISSOLUTION OF CARBON ADLAYERS INTO THE (110) FACE OF NICKEL
Radhesyam Sau and John B. Hudson 15 Dec. 1978 20 p
(Contract N00014-75-C-0730; NR Proj. 056-533)
(AD-A064551; TR-6) Avail: NTIS HC A02/MF A01 CSCL 11/2

The rate of carbon dissolution from adsorbed layers through the (110) face of a nickel crystal has been measured for a wide range of initial surface carbon concentrations over the temperature range from 600 to 913K. Auger electron spectrometry was used to measure the decrease in surface carbon concentration with time at temperature. For graphitic monolayers at T greater than 873K, dissolution is controlled by the transport of carbon from adsorbed layer to bulk. For dilute adlayers at T approximately 723K, dissolution is controlled by the bulk diffusion rate of carbon. At intermediate values of initial carbon concentration and temperture, quantitative treatment of the dissolution rate was not possible. Author (GRA)

N79-22288# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
TITANIUM ALLOY IGNITION AND COMBUSTION Final Report, 30 Sep. 1977 - 30 Sep. 1978
V. G. Anderson and B. A. Manty 30 Oct. 1978 99 p
(Contract N62269-77-C-0481)
(AD-A064993; PWA-FR-10520; NADC-77153-30) Avail: NTIS HC A05/MF A01 CSCL 11/6

The objective of this program was to determine the relative ignition and combustibility characteristics of titanium alloys. Nine titanium alloys were subjected to a laser ignition source at each of two conditions of temperature, pressure, and airsteam velocity typical of gas turbine engine compressor environments. In addition a concurrent study was conducted on the effect of Ti 8-1-1 specimen thickness on combustion parameters. All alloys ignited but two(Ti 20Ni and Ti 13Cu) failed to sustain combustion. Burn severity and chordwise and spanwise burn velocities were determined for those alloys which burned. Thickness was found to influence these burn parameters. The extent of this influence was shown to have a high degree of correlation. Author (GRA)

N79-22289# Lehigh Univ., Bethlehem, Pa. Francis McDonald Sinclair Memorial Lab.
CORROSION CONTROL BY COATINGS, DISCUSSION Final Report, 1 May 1978 - 31 Jan. 1979
Henry Leidheiser, Jr. 2 Feb. 1979 29 p Held at Bethlehem, Pa., 13-15 Nov. 1978
(Grant N00014-78-G-0029)
(AD-A064990) Avail: NTIS HC A02/MF A01 CSCL 11/3

The grant provided support for a discussion on corrosion by coatings which was held in the Sinclair Laboratory, Lehigh University on November 13-15, 1978. The program was arranged in six half-day sessions on the following subjects: Sacrificial Coatings for Corrosion control; Barrier Coatings for Corrosion Control; Pretreatment Processes and Conversion Coatings; Inhibitors in Coatings; Design of Coatings for Other than Corrosion Control; and Coatings Science. GRA

N79-22290# Naval Research Lab., Washington, D. C.
THE CORROSION BEHAVIOR AND RUTHERFORD BACKSCATTERING ANALYSIS OF PALLADIUM IMPLANTED TITANIUM Final Report
G. K. Hubler and E. McCafferty Nov. 1978 32 p refs
(AD-A064974) Avail: NTIS HC A03/MF A01 CSCL 11/6

The corrosion behavior of Pd implanted Ti in boiling 1 Molar sulfuric acid has been investigated by means of high resolution Rutherford backscattering (RBS) profiles of the Pd concentration as a function of corrosion time, and by electrochemical methods consisting of corrosion potential versus time curves and potentiostatic polariation data. Employing ion-implanted Xe as a surface 'marker', absolute corrosion rates were determined by RBS analysis and compared to corrosion rates determined from the polarization curves. The rate of Ti dissolution is found to be reduced by about three orders-of-magnitude for Pd implanted samples. The corrosion potential-time curves and high resolution RBS data both show that soon after immersion, and Pd surface concentration rises to 20 atomic percent because of preferential dissolution of Ti and that the Pd is retained in the surface for corrosion time of up to 9 hr. The steady state corrosion potential of implanted samples is close to that of pure Pd and 800 mV anodic with respect to the corrosion potential of pure Ti. The protection is explained by the fact that the mixed electrode potential is more noble than the critical potential for passivity of Ti, resulting in a markedly reduced dissolution rate.
Author (GRA)

N79-22291# Worcester Polytechnic Inst., Mass.
STUDY OF ZIRCALOY-4: STEAM OXIDATION REACTION KINETICS Final Report
Ronald R. Biederman, Richard D. Sisson, Jr., Jeremy K. Jones, and Wilson G. Dobson Apr. 1978 109 p refs Sponsored by EPRI
(EPRI-NP-734-Pt-2) Avail: NTIS HC A06/MF A01

Experimental studies utilizing a Gleeble were performed to evaluated the oxidation of reactor grade Zircaloy-4 tubing in steam throughout the 1200 F to 1800 F temperature range. Oxidation behavior in this temperature range was found to be substantially different from that predicted by either the Baker-Just

equation or extrapolation of oxidation data from temperatures above 1800 F. Preoxidation of Zircaloy-4 below the alpha/beta Zircaloy transformation was found to have a substantial effect on the rate of subsequent oxidation at temperatures above 1800 F with this effect increasing as the preoxidation thickness increased. Furthermore, a preoxidation treatment prior to clad rupture was observed to reduce the extent of swelling prior to clad rupture in internal pressurization studies. Evaluation of the load carrying ability of Zircaloy-4 for both as-received and 10 micrometers preoxidized cladding made under both internal pressurization and axial loading conditions. DOE

N79-22292# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
COBALT AND NICKEL REMOVAL FROM ZINC SULFATE ELECTROLYTE BY SOLVENT EXTRACTION AND PRECIPITATION TECHNIQUES
Richard G. Sandberg and Terry L. Hebble 1978 23 p refs
(PB-289773/4; BM-RI-8320) Avail: NTIS HC A02/MF A01 CSCL 11F

Prepared zinc sulfate solutions containing about 190 gpl of zinc and 50 ppm of both cobalt and nickel were treated using combinations of complexing reagents, solvent, pH, concentration, time, and temperature. The following complexing reagents gave the best results: alpha-nitroso-betanaphtol; beta-nitroso-nitroso-alpha-naphtol; 1,2 cyclohexane dione dioxime (nioxime); di-2-pyridyl ketone oxime; and dimethylglyoxime. These reagents in appropriate solvent lowered the cobalt and nickel levels to less than 0.1 ppm using solvent extraction or precipitation techniques. Several flowsheets are presented for the removal and recovery of cobalt and nickel. Prepared zinc sulfate solutions purified by solvent extraction and precipitation techniques were successfully electrowon to produce good deposits. GRA

N79-22293# Bureau of Mines, Denver, Colo. Intermountain Field Operation Center.
OCCURRENCE AND RECOVERY OF CERTAIN MINOR METALS IN THE SMELTING-REFINING OF COPPER Information Circular, 1971 - 1974
John G. Parker 1978 89 p refs
(PB-290108/0; BM-IC-8778) Avail: NTIS HC A05/MF A01 CSCL 11F

The occurrence of arsenic, selenium, tellurium, gold, silver, platinum, and palladium in copper ores was studied their distribution during subsequent processing steps was determined. The relative importance of these areas as a source of the respective byproducts is assessed. The effects of antipollution legislation to improve control of sulfurous and other emissions that may affect recovery of certain byproducts was noted. Newer technology illustrating hydrometallurgical techniques that may affect the recovery of minor metals is included. GRA

N79-22294# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
SULFURIC ACID EXTRACTION TECHNIQUE FOR RECOVERING ZINC AND SULFUR FROM SPHALERITE
H. H. Dewing and A. A. Cochran 1978 19 p refs
(PB-289981/3; BM-RI-8322) Avail: NTIS HC A02/MF A01 CSCL 11F

A laboratory-scale, ambient pressure technique which yields zinc sulfate and elemental sulfur from sphalerite (ZnS) concentrates by reaction with 80 to 85 pct sulfuric acid at 175 to 200 C was investigated. More than 98 pct of the zinc was recovered as zinc sulfate after 3 hr at 175C. Advantages of the proposed method over conventional roasting and leaching are: virtual elimination of sulfur dioxide, production of a solid sulfur byproducts, and high zinc recoveries by elimination of zinc recoveries by elimination of zinc ferrite losses. GRA

N79-22295# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.
TUNGSTEN RECOVERY FROM SEARLES LAKE BRINES
P. B. Altringer, W. N. Marchant, R. O. Dannenbert, and P. T. Brooks 1978 21 p refs
(PB-289866/6; BM-RI-8315) Avail: NTIS HC A02/MF A01 CSCL 11F

The Bureau of Mines conducted laboratory tests to devise a procedure for recovering a marketable grade of tungsten from the brine of Searles Lake, Calif. The brine contains only 56 parts per million of tungsten (70 parts per million of WO3). Using ion exchange resins synthesized by Bureau chemists, 98 percent of the tungsten was extracted from the brine and 92 percent of the tungsten was recovered as a marketable iron-tungsten concentrate containing 44 percent tungstic oxide. Although major technical problems have largely been resolved, research is progressing to escalate testing in a process-development unit to provide more reliable data for an economic appraisal. GRA

N79-22296# Bureau of Mines, Washington, D. C.
TUNGSTEN Mineral Commodity Profiles
Ben A. Kornhauser and Philip T. Stafford Sep. 1978 29 p refs
(PB-289801/3; BM-MCP-21) Avail: NTIS HC A03/MF A01 CSCL 11F

Comprehensive data is presented on tungsten including industry structure, uses, reserves-resources, geology, technology, supply-demand relationships, byproducts and coproducts, strategic considerations, economic factors and problems, operating factors and problems, and outlook to 2000. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-22297 Florida Univ., Gainesville.
FURAN-MALEIC ANHYDRIDE COPOLYMER: STRUCTURE AND MECHANISM OF FORMATION Ph.D. Thesis
Yousif Ali Ragab 1978 145 p
Avail: Univ. Microfilms Order No. 7907789

The mechanistic study was mainly undertaken to elucidate the roles of F-MAH Diels-Aiers adduct, and the charge-transfer (CT) complex in the radical initiated copolymerization. The adduct reverted substantially to the monomers under the reaction conditions, but the amount of adduct remaining at equilibrium was quite appreciable. On polymerizing the adduct in the presence of F-d sub 4, the latter was incorporated in the copolymer to an extent indicative of free monomer exchange. The adduct is not directly involved in polymerization. The initiation, propagation, chain-transfer, and termination reactions were discussed. The complex structure of MF-MAH copolymer was ascribed to the relatively high concentration and high reactivity of the complex, as well as the asymmetry of MF molecule. Dissert. Abstr.

N79-22298 Michigan Univ., Ann Arbor.
A STUDY OF HEAT TRANSFER TO DILUTE POLYMER SOLUTIONS IN NUCLEATE POOL BOILING Ph.D. Thesis
Chi-Bao Miaw 1978 207 p
Avail: Univ. Microfilms Order No. 7907130

An experimental investigation of nucleate pool boiling heat transfer to dilute aqueous polymer solutions heated from a horizontal and chromium-plated copper surface scratched by using a 600 grit emery paper was performed. Surfactant hydroxyethyl cellulose (Natrosal-H) and nonsurfactant polyacrylamide (Separan-10 and Separan-30) were employed to prepare solutions with the concentration ranging from 50 ppm to 1000 ppm for the boiling test. The measured results showed that boiling heat transfer in Natrosal-H solutions was enhanced orderly as the polymer concentration was increased, and was significantly higher than for water boiling. An experimental study of bubble formation, growth and departure was conducted from the nucleation at artificial sites located on a highly polished and gold-plated copper surface. The results showed that bubble growth and departure time in 500 ppm Natrosal-H solution was the shortest. Dissert. Abstr.

N79-22299 Northwestern Univ., Evanston, Ill.
IMPURITY EFFECTS ON THE INTERMEDIATE AND THE FINAL STAGE SINTERING OF ALUMINA Ph.D. Thesis
Yu-Ping Tsui 1978 211 p
Avail: Univ. Microfilms Order No. 7907950

Sintering of alumina powder doped with Ti and Fe was studied. A modified intermediate-stage sintering model based

on Johnson's model is presented. This model clearly demonstrates that for doped alumina, the prevailing sintering mechanism is volume diffusion. The apparent volume-diffusion coefficient is greater than the self-diffusion coefficients for both Al and O in alumina. The discrepancy is explained by the effect of an enrichment layer of background impurities or dopants on the grain boundary. It is postulated that the volume diffusity is enhanced by the effect of segregation of the dopants and the grain-boundary diffusivity is reduced by the effects of a space charge and segregation. As a result, only the volume diffusion mechanism is observed in the intermediate-stage sintering of doped alumina. The amount of Ti and Fe in alumina determines whether the specimens are donor dominant or acceptor dominant. Donor dominant, aluminum vacancies are major native defects, and acceptor dominant, aluminum interstitials are major native defects. Dissert. Abstr.

N79-22300* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PREPARATION OF HETEROCYCLIC BLOCK COPOLYMER OMEGA-DIAMIDOXIMES Patent

Leonard O. Ross (Stanford Research Inst., Menlo Park, Calif.), Robert W. Rosser, and Mark Iannone, inventors (to NASA) (Stanford Research Inst., Menlo Park, Calif.) Issued 20 Mar. 1979 6 p Filed 17 Oct. 1977 Supersedes N78-10292 (16 - 01, p 0044)

(NASA-Case-ARC-11060-1; US-Patent-4,145,524; US-Patent-Appl-SN-843090; US-Patent-Class-528-401; US-Patent-Class-260-307G; US-Patent-Class-528-422) Avail: US Patent and Trademark Office CSCL 11C

Diamidoxime monomers are intermolecularly and thermally condensed to form a heat and chemical resistant polymer containing 1,2,4-oxadiazole linkages: with identical bivalent organic radicals or any combination of bivalent organic radicals selected from the group consisting of -(CX2)p-, where P ranges from 2 to 8 when X is fluorine and 2 to 18 when X is hydrogen, chlorine, nitro or aryl; arylene; and an oligometric or polymeric radical prepared by reacting a dicarboxylic acid halide with a fluorinated epoxide.

Official Gazette of the U.S. Patent and Trademark Office

N79-22301*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PROCESS FOR THE PREPARATION OF NEW ELASTOMERIC POLYTRIAZINES Patent Application

Robert W. Rosser and Roger A. Korus, inventors (to NASA) (San Jose State Univ., Calif.) Filed 9 Apr. 1979 15 p (NASA-Case-ARC-11248-1; US-Patent-Appl-SN-028300) Avail: NTIS HC A02/MF A01 CSCL 07D

New crosslinked elastomeric polytriazines were prepared by a 4 step procedure which consists of: (1) forming a poly (imidoylamidine) by the reaction under reflux conditions of anhydrous ammonia with certain perfluorinated alkyl or alkyletdinitriles; (2) forming a linear polytriazine by cyclizing the imidoylamidine linkages by reaction with certain perfluorinated alkyl or alkylether acid anhydrides or halides; (3) extending the linear polytriazine chain by further refluxing in anhydrous ammonia; and (4) heating to cyclize the new imidoylamidine linkages and thereby crosslink the polymer. NASA

N79-22302*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE 1,2;4-OXADIAZOLE ELASTOMERS Patent Application

Robert W. Rosser, Ibrahim M. Shalhoub (San Jose State Univ. Foundation, Calif.), and Hanoi Kwong, inventors (to NASA) (San Jose State Univ. Foundation, Calif.) Filed 9 Apr. 1979 17 p (NASA-Case-ARC-11253-1; US-Patent-Appl-SN-028301) Avail: NTIS HC A02/MF A01 CSCL 07D

Crosslinked 1,2,4-oxadiazole elastomers were prepared by thermally condensing: (1) monomers having the formula H2N(HON) C-R-Q, where Q is a triazine ring-forming group such as nitrile or amidine or a mixture of such groups with amidoxime; or (2) a mixture of said monomer with R[C(NOH)NH2]2, with R in these formulas standing for a bivalent organic radical having the formula: -(CX2) sub p-, or -CFY(OCF2CFY) sub m O(CX2) sub p O(CFYCF2O) sub n CFY-, where X is fluorine or hydrogen, Y is fluorine or trifluoromethyl, p ranges from 1 to 18, and m + n ranges from 2 to 7. In the monomer charge, the overall proportions of amidoxime groups to triazine ring-forming groups varies depending on the extent of crosslinking desired in the final polymer. NASA

N79-22303# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

MOSSBAUER STUDIES OF METALLIC GLASSES M.S. Thesis

Lonnie D. Roberts Dec. 1978 92 p refs

(AD-A064049; AFIT/GNE/PH/78D-22) Avail: NTIS HC A05/MF A01 CSCL 20/3

This study attempted to obtain simplified Mossbauer spectra of the metallic glasses Fe80B20 and Fe80P8.5C4.5B7 as the spectra previously obtained for these materials were not easily analyzed. External magnetic fields of 0.4, 1.6, and 6.4 kGauss were applied to each material and spectra obtained on a Ranger Electronics Mossbauer spectrometer. A twelve-site substitutional solid model was employed to obtain the Mossbauer parameters. The results suggest an external magnetic field-related structure associated with these compounds. GRA

N79-22304# Army Materials and Mechanics Research Center, Watertown, Mass.

SYNTHESIS AND BALLISTIC EVALUATION OF SELECTED TRANSPARENT POLYURETHANE BLOCK COPOLYMERS. PART 4: EFFECTS OF ENVIRONMENTAL FACTORS UPON BALLISTIC RESPONSE Final Report

Anthony F. Wilde, Richard W. Matton, Joseph M. Rogers, and Stanley E. Wentworth Aug. 1978 26 p refs

(DA Proj. 1L1-62105-AH-84)

(AD-A064044; AMMRC-TR-78-33-Pt-4) Avail: NTIS HC A03/MF A01 CSCL 19/4

Investigation has been continued of polyurethane block copolymers for possible application as transparent armor. For a typical formulation, the V(50) ballistic limit velocity exhibited a maximum at room temperature, with lower values at -50 F and -175 F. Aging at ambient conditions tended to decrease the brittleness and raise the V50 of these polymers. High values of relative humidity led to softening and ductile response of brittle formulations. Immediate desiccation of brittle formulations caused retention of hardness and brittleness, whereas after prior humidification, desiccation removed much water but did not reverse the prior transition to ductile ballistic reponse. Incorporation of selected additives had little effect upon the properties of these polymers. Exposure produced changes in weight and hardness which may correlate with humidities and weathering processes; the corresponding changes in V(50) were small and not directly related to these other changes. Author (GRA)

N79-22305# Ford Motor Co., Dearborn, Mich.

TIME-TEMPERATURE STUDIES OF HIGH TEMPERATURE DETERIORATION PHENOMENON IN LUBRICANT SYSTEMS: SYNTHETIC ESTER LUBRICANTS Annual Report, 1 Oct. 1977 - 30 Sep. 1978

L. R. Mahoney, S. Korcek, P. A. Willermet, E. J. Hamilton, and R. K. Jensen 1 Oct. 1978 46 p refs

(Contract F44620-76-C-0097; AF Proj. 2303)

(AD-A064563; AFOSR-79-0002TR) Avail: NTIS HC A03/MF A01 CSCL 11/8

A study of the lengths of the inhibition periods caused by the addition of varying amounts of the bisphenol antioxidant, 4,4:-methylenebis (2,6-di-tertbutylphenol), BPH, on the autoxidation of pentaerythrityl tetraheptanoate, PETH, in a batch reactor at 180, 200 and 220C has been carried out. A kinetic analysis based upon these results together with preliminary results on the BPH decay and quinone methide product formation as a function of time yield a general equation for the rate of decay of BPH. A study of wear rates at 100C manifested by pure PETH and by slightly oxidized PETH has been completed. At one ca. 2% oxidation the wear rate is increased by a factor of 8 over that of pure PETH. This result together with those from various ancillary studies are consistent with the view that hydroperoxides, perhaps in combination with alpha,gamma-substituted difunctional oxidation products, lead to a rapid corrosive wear phenomena. Author (GRA)

N79-22306# Boeing Military Airplane Development, Seattle, Wash.

ENVIRONMENTAL EXPOSURE ON THERMOPLASTIC ADHESIVES Final Report, 20 May 1977 - 20 Apr. 1978
S. G. Hill, E. E. House, and J. T. Hoggatt Dec. 1978 83 p refs
(Contract N00019-77-C-0340)
(AD-A064774; D180-24744-1) Avail: NTIS HC A05/MF A01 CSCL 11/1

Two thermoplastic polymers (PKXA Polysulfone and R-5000 polyphenylsulfone) having high temperature capabilities(-300 F) were evaluated as adhesives for bonding steel and titanium adherends. The PKXA polysulfone adhesive was also evaluated on polyimide/glass composites. Chromic acid anodize and sulfuric acid anodize were selected as the surface treatments for titanium and steel, respectively. The primer system selected was BR-34 polyimide primer (American Cyanimid) subsequently coated with a thin solution of the bonding resin. Prior to bonding, the thermoplastic resins were solution coated on 112E glass with A-1100 finished for bondline control. The environmental resistance of the PKXA and R-5000 adhesives were evaluated after exposure to thermal environments (180, 300 F), deicing fluid, JP-4 fuel, hydraulic fluids (MIL-H-83306, MIL-H-5606), synthetic lubricant (MIL-L-7808), salt water, cleaning solvent (Stoddard), Naphtha, corrosion inhibitor MIL-C-85054, Naphtha, and caustic (NaOH) solutions. Lap shear and crack extension specimens were used to evaluate the environmental resistance of the adhesive systems. Peel, creep and fatique properties were determined for the adhesives on steel and titanium adherends. Author (GRA)

N79-22307# Lehigh Univ., Bethlehem, Pa. Materials Research Center.
DISCUSSION OF A MODEL OF FATIGUE CRACK GROWTH IN POLYMERS
Richard W. Hertzberg, Michael D. Skibo, John A. Manson, and J. K. Donald Dec. 1978 16 p refs
(Contract N00014-77-C-0633)
(AD-A063654; TR-1) Avail: NTIS HC A02/MF A01 CSCL 11/9

A model was previously proposed by Hertzberg, Skibo, and Manson to account for the sensitivity of fatigue crack growth rates to frequency. The model was based on the hypothesis that the mechanical Beta transition controls the fatigue deformation and on the use of time-temperature relationships to determine the match between the Beta transition frequency and temperature and the frequency and temperature of the test. An alternate model was recently proposed by Williams, who interpreted the frequency sensitivity in terms of the sensitivity of fracture toughness (and Young's modulus) to frequency. In this communication, results of new experiments with nylon 66 are presented and discussed. Since Young's modulus was independent of test frequency for nylon 66, and for several other polymers, it was concluded that the author's earlier hypothesis was not invalidated. Author (GRA)

N79-22308# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SIMULATION OF THE DYNAMIC TENSILE CHARACTERISTICS OF NYLON PARACHUTE MATERIALS Final Report, 1 Nov. 1973 - 1 Nov. 1976
Robert E. McCarty Nov. 1978 183 p refs
(AD-A063497; AFFDL-TR-78-169) Avail: NTIS HC A09/MF A01 CSCL 11/5

The empirical development of nylon material subroutines for use in computer analysis of parachute system dynamics is discussed. The subroutines account for material plasticity, creep and hysteresis. They predict peak forces and strains accurately (+ or - 5%) and are valid over broad ranges of strain rate (three decades) and tensile load (zero to minimum breaking strength). The strain rate sensitivity of nylon is shown to be a manifestation of material creep. Previous models are simplistic by comparison and have been, in general, unsatisfactory. A package of data processing computer programs also developed provides the capability to quickly generate additional subroutines for similar materials from limited test data. Author (GRA)

N79-22309# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
MODELLING OF THE VISCOELASTIC BEHAVIOR OF HOMOGENEOUS AND HETEROGENEOUS BLENDS OF POLYISOPRENE AND POLYBUTADIENE
R. E. Cohen and A. R. Ramos Jan. 1979 40 p refs
(Contract N00014-77-C-0311)
(AD-A064145; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/10

The mechanical model of Takayanagi was used to describe the viscoelastic behavior of various blends of a ternary elastomer system (cis 1,4 polyisoprene, 1,4 polybutadiene and the corresponding polyisoprene/polybutadiene diblock) for which extensive mechanical properties data have already been reported. Through the use of appropriate composition temperature shifts which rely on the assumption of free volume additivity, it was possible to model the behavior of the homogeneous diblock copolymers of polyisoprene and polybutadiene as well as various homogeneous binary and ternary blends of a diblock with either or both of the diene homopolymers. Heterogeneous ternary blends were also modelled successfully assuming that the diblock was solubilized preferentially by one of the phases in the blend. The model predictions were very sensitive to the location of the diblock, and thus comparison with experimental results provided a useful tool for verifying earlier assumptions regarding the role of the homogeneous diblock copolymers in these elastomer blends. Author (GRA)

N79-22310# Illinois Univ. at Urbana-Champaign. Dept. of Chemistry.
A VERSATILE APPROACH FOR INVESTIGATING SITE SEPARATION IN FUNCTIONALIZED ORGANIC POLYMERS CONTAINING CERTAIN DONOR GROUPS Interim Technical Report
Russell S. Drago and John H. Gaul Feb. 1979 30 p refs
(Contract N00014-78-C-0245)
(AD-A064325; TR-1) Avail: NTIS HC A03/MF A01 CSCL 07/3

Resins containing pendant chloromethyl groups were prepared by suspension co-polymerization techniques and functionalized with imidazole. This imidazole polymer, at various percent crosslinking and loading was used to examine the utility of Co(DPGB)2-2MeOH as a reagent to investigate the existence of isolated functionalized sites in the resin. In this study, Co(DPGB)2-2MeOH is attached to the imidazole containing polymer via axial coordination and the resulting polymer complexes studied by ESR. The ESR analysis of the coordinated cobalt centers yielded characteristic spectra of 1:1 and 2:1 imidazole-cobalt adducts depending on the crosslinking and loading of imidazole. The reaction of the polymer bound cobalt(II) complex with dioxygen has been investigated. Factors influencing the comparison of the oxygen affinity for the polymer bound complex with solution data are discussed. Author (GRA)

N79-22311# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
A COMPUTERIZED ACOUSTICAL ARRAY SYSTEM TO TEST BONDED RADOME JOINTS Final Technical Report
John A. Schaeffel, Jr., Virgil G. Irelan, Bobby R. Mullinix, and Martin D. Fox 5 Oct. 1978 79 p refs
(AD-A064217; DRDMI-T-78-96) Avail: NTIS HC A05/MF A01 CSCL 14/2

Ceramic randomes are tested using an ultrasonic transducer array in the vicinity of the randome attachment ring bond line where the structural problems are particularly great. The array consists of 14 one-fourth inch transducers in line, with water couplant and operating in a 2.25 MWZ pulse/echo mode. Mechanical rotation of the radome generates the scan axis along the radome circumference. Flaws are determined by the character of the ultrasonic echo from the bond line. The resolution limit is one-fourth inch with one-fourth inch transducers. If better resolution is desired one eight inch steps can be taken in both the horizontal and vertical directions to obtain approximately one eighth inch resolution. Displays are presented on storage monitors and computer plots. Each scan of the radome joint takes approximately one minute. The results of these studies show clearly that the array is capable of differentiating three major types of flaws: silica inclusions and cracks, adhesive silica flaws, and adhesive fiberglass flaws. Author (GRA)

N79-22312# Defence Research Establishment, Ottawa. (Ontario).
POLY(ORGANOPHOSPHAZENES), SYNTHESIS AND

APPLICATIONS OF A NEW CLASS OF TECHNOLOGICALLY IMPORTANT POLYMERS
J. M. McAndless Jan. 1979 28 p refs
(AD-A064674; DREO-95) Avail: NTIS HC A03/MF A01 CSCL 07/2

The poly(organophosphazenes) are a new class of high polymers based on an 'inorganic' backbone of alternating phosphorus and nitrogen atoms. These polymers show considerable promise in meeting materials requirements that cannot be met by conventional organic polymers. In this report, the history of phosphazene polymer development is briefly reviewed, the synthesis and properties of poly(organophosphazenes) are described and some of the problems associated with their synthesis are outlined. The potential technological applications of these polymers as extreme-service materials, protective coatings, textile products and biomedical materials, are also described. Author (GRA)

N79-22313# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
OXIDATIVE STABILIZATION OF ACRYLIC FIBERS. 4: MOISTURE SENSITIVITY
S. B. Warner, L. H. Peebles, Jr., and D. R. Uhlmann Jan. 1979 11 p refs
(Contract N00014-75-C-0542)
(AD-A064552; TR-12) Avail: NTIS HC A02/MF A01 CSCL 11/5

Stabilized acrylic fibers are very hygroscopic. Dried fibers rapidly equilibrate under ambient condition with a gain in moisture of about 8 wt. percent and concurrently elongate about 1.5 percent. Author (GRA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-22314# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
THE BEHAVIOR OF SOME WAXES IN COMPOSITION B
William J. Fisco, J. Haberman, and T. C. Castorina Dec. 1978 45 p refs
(AD-A064105; AD-E400260; ARLCD-TR-78067) Avail: NTIS HC A03/MF A01 CSCL 19/1

A gel permeation chromatographic technique, checked by mass spectrometry, has been used to determine the molecular weight distributions of the various hydrocarbon waxes. The technique shows high potential as a method for determining the degree of fractionation of waxes in Comp B casts. The dispersive, wettability and solubility properties of the waxes in the TNT/RDX matrix were also investigated. Author (GRA)

N79-22315# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
PROCEEDINGS OF THE CONFERENCE OF THE STANDARDIZATION OF SAFETY AND PERFORMANCE TESTS FOR ENERGETIC MATERIALS, VOLUME 2
Louis Avrami, H. J. Matsuguma, and R. F. Walker Nov. 1978 68 p refs Conf held at Dover, N. J., 21-23 Jun. 1977
(AD-A064107; AD-E400254; ARLCD-SP-77004-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 19/1

This report is a compilation of the workshop discussions held at the Conference on the Standardization of Safety and Performance Tests for Energetic Materials which was held at ARRADCOM, Dover, NJ on 21-23 June 1977. Author (GRA)

N79-22316# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
FLUIDIZED BED INCINERATOR FOR DISPOSAL OF PROPELLANTS AND EXPLOSIVES
Robert Scola and Joseph S. Santos Oct. 1978 129 p refs
(AD-A064124; AD-E400242; ARLCD-TR-78032) Avail: NTIS HC A07/MF A01 CSCL 19/1

The disposal of waste propellants and explosives (P and E) has come under the close scrutiny of the Environmental Protection Agency (EPA) since the ban on open burning. In order to conform to current and anticipated regulations, the fluidized bed incineration technique was developed and evaluated as a potential solution to this disposal problem. This incineration technique was chosen due to its reported characteristics of high combustion efficiency, low emissions, high heat sink capacity, low operating cost, and inherent safety features. The evaluation proves that the fluidized bed incinerator promises to be well suited for the destruction of waste P and E because it can safely destroy the P and E wastes and conform to current and anticipated standards for NOx, HC, and CO without the use of abatement equipment. GRA

N79-22317# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF HAZARDS CLASSIFICATION DATA ON PROPELLANTS AND EXPLOSIVES Final Report
Hyla S. Napadensky, R. Joyce, Richard Rindner, and Dan Satriana Nov. 1978 236 p refs
(Contract DAAA21-76-C-0211)
(AD-A064138; AD-E400257; IITRI-J6377; ARLCD-CR-78035) Avail: NTIS HC A11/MF A01 CSCL 19/1

This study was aimed at the development of a procedure for the hazards classification of in-process materials. The study included the following phases: (1) Collection, review and interpretation of sensitivity and accident data; (2) Detailed analysis of compiled accident data and development of classification procedure; (3) Review and critique of current hazards classification procedures and quantity distance requirements; (4) Preliminary development of a hazards classification procedure for in-process materials; and (5) Experimental evaluation of selected small-scale tests for application in the hazards classification of in-process materials. It was found that the most common accident causes are friction, impact, electrostatic discharge, and thermal heating. Test methods are suggested for evaluating the sensitivity of in-process materials to these stimuli. A preliminary outline is presented of a new explosive classification procedure that considers other hazards (viz. fragments, thermal effects, glass breakage) in addition to blast. Author (GRA)

N79-22318# Hittman Associates, Inc., Columbia, Md.
SRC (SOLVENT REFINED COAL) SITE, SPECIFIC POLLUTANT EVALUATION. VOLUME 1: DISCUSSION Final Report, Nov. 1977 - Sep. 1978
Homer T. Hopkins, Kathleen M. McKeon, Carolyn R. Thompson, and E. Earl Weir Nov. 1978 440 p refs 2 Vol.
(Contract EPA-68-02-2162)
(PB-291495/0; EPA-600/7-78-223a) Avail: NTIS HC A19/MF A01 CSCL 21D

The potential environmental effects of the multimedia waste streams from the operation of a standard-size solvent refined coal (SRC-1 and SRC-2) liquefaction facility utilizing 28, 123 Mg of Illinois No. 6 coal per day are assessed. Regulatory standards and guidelines are discussed relative to the emerging synthetic fuels technology. Research needs are identified in terms of SRC technology, monitoring, and environmental sciences. Study results indicate concern for emissions from auxiliary units (cooling towers, boilers, sulfur recovery), fugitive process discharges, solid wastes, leachate contamination of water, polycyclic aromatic hydrocarbon emissions, hazardous wastes, water treatment effectiveness, and interactions within and among media. GRA

N79-22319# Hittman Associates, Inc., Columbia, Md.
SRC (SOLVENT REFINED COAL) SITE--SPECIFIC POLLUTANT EVALUATION. VOLUME 2: APPENDICES Final Report, Nov. 1977 - Sep. 1978
Homer T. Hopkins, Kathleen M. McKeon, Carolyn R. Thompson, and E. Earl Weir Nov. 1978 273 p refs 2 Vol.
(Contract EPA-68-02-2162)
(PB-291496/8; EPA-600/7-78-223) Avail: NTIS HC A12/MF A01 CSCL 21D

Data are presented in support of a discussion of the environmental effects of the multimedia waste streams from a standard solvent refined coal liquefaction facility. Information on the methodologies involved, including multimedia environmental goals and source analysis methodology is included. The 1977 amendments to the Clean Air, Clean Water, and Hazardous Waste Acts are summarized. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-22320# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTERNAL FLOW ASPECTS AND CIRCUIT DESIGN OF HEATING AND VENTILATION SYSTEMS
May 1974 349 p refs In ENGLISH; partly in FRENCH Lecture held at Rhode-Saint-Genese, Belgium, 6-10 May 1974
(VKI-Lecture-Series-68) Avail: NTIS HC A15/MF A01

Topics discussed include: viewpoints about the velocity-area methods; fire safety; determining the economics of ventilation networks; noise aspects in heating and air conditioning systems; terminal devices; design data; and flow and temperature regulating devices. For individual titles, see N79-22321 through N79-22327.

N79-22321# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SOME VIEWPOINTS ABOUT THE VELOCITY-AREA METHODS USED IN THE AIR-HANDLING SYSTEMS FOR ON SITE TESTS
P. Amiard (CETIAT, Orsay, France) *In its* Internal Flow Aspects and Circuit Design of Heating and Ventilation Systems May 1974 68 p refs (For primary document see N79-22320 13-31)
Avail: NTIS HC A15/MF A01

Pitot-static tube is described. The effects of tip and stem positions on indicated static pressure and the effects of yaw on the indicated differential pressure are tabulated. S.E.S.

N79-22322# State Univ. of Gent (Belgium).
FIRE SAFETY IN CIRCUIT DESIGN OF HEATING AND VENTILATING SYSTEMS
E. Dick *In* Von Karman Inst. for Fluid Dyn. Internal Flow Aspects and Circuit Design of Heating and Ventilation Systems May 1974 15 p (For primary document see N79-22320 13-31)
Avail: NTIS HC A15/MF A01

The reaction to fire of the materials and the fire resistance of the building elements are described. The analysis of the problem of fire prevention and protection, precautions to smoke infiltration into adjacent compartments and into the escape routes, precautions related to fire resistance, and regulations and recommendations for air conditioning and ventilation systems are discussed. S.E.S.

N79-22323# Societe Technic Air, Geneva (Switzerland).
DETERMINING THE ECONOMICS OF VENTILATION NETWORKS [DETERMINATION ECONOMIQUE DES RESEAUX AERAULIQUES]
G. Friedling *In* Von Karman Inst. for Fluid Dyn. Internal Flow Aspects and Circuit Design of Heating and Ventilation Systems May 1974 85 p refs In FRENCH (For primary document see N79-22320 13-31)
Avail: NTIS HC A15/MF A01

Air distribution networks can always be represented by a tree in which one of the extremities is constituted by a single point where the energy necessary to assure ventilation is transmitted to the air flow. The other extremity is constituted by multiple points or terminals from which the air is drawn towards the ventilator. In analyzing such a network, the quantitative and qualitative restraints imposed on either the network or its source by functional, constructional, and economic constraints must be considered. Procedures for determining these constraints are given for a defined air conditioning system.
Transl. by A.R.H.

N79-22324# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
NOISE ASPECTS IN HEATING AND AIR CONDITIONING SYSTEMS **c71**
F. Henderieckx *In its* Internal Flow Aspects and Circuit Design of Heating and Ventilation Systems May 1974 91 p refs (For primary document see N79-22320 13-31)
Avail: NTIS HC A15/MF A01

Physics of sound, architectural and room acoustics, noise and hearing, choice of design criteria, sound insultation, fan noise transmission in ducts, flow noise, breakout throught duct walls, noise to the exterior, laboratory testing, and cost aspect are discussed. S.E.S.

N79-22325# Heating and Ventilating Research Association, Bracknell (England).
TERMINAL DEVICES IN HEATING AND VENTILATING SYSTEMS
M. J. Holmes *In* Von Karman Inst. for Fluid Dyn. Internal Flow Aspects and Circuit Design of Heating and Ventilation Systems May 1974 32 p refs (For primary document see N79-22320 13-31)
Avail: NTIS HC A15/MF A01

The factors affecting the quality of an air conditioned environment are discussed. Topics discussed include: requirements of the air distribution system, room air distribution with sidewall mounted grilles, ceiling discharge, mean room ventilation, flow over beams and light fixtures, return grilles, and heat exchangers. F.O.S.

N79-22326# British Hydromechanics Research Association, Cranfield (England).
DESIGN DATA
D. S. Miller *In* Von Karman Inst. for Fluid Dyn. Internal Flow Aspects and Circuit Design of Heating and Ventilation Systems May 1974 61 p refs (For primary document see N79-22320 13-31)
Avail: NTIS HC A15/MF A01

The relevant factors affecting head losses in systems are outlined. Particular attention is given to the definition of a system loss coefficient base on isolated components with long inlet and outlet pipes. The calculation of friction losses in straight pipes of circular and non-circular section is is presented. Examples are given to illustrate calculation procedures for friction loss, pipe size or flow rate. The head loss for flow through accurately made components with long inlet and outlet pipes is discussed. An estimate of the effects of closely spaced components on isolated component loss coefficients is obtained. Loss coefficients for typical commercial pipe fittings are summarized along with the available loss coefficients for valves. Loss coefficients for miscellaneous system components, such as screens and differential flow meters, are included. S.E.S.

N79-22327# Hart (S. A.) and Cooley N. V., Lokeren (Belgium).
FLOW AND TEMPERATURE REGULATING DEVICES
P. Pieters *In* Von Karman Inst. for Fluid Dyn. Internal Flow Aspects and Circuit Design of Heating and Ventilation Systems May 1974 17 p (For primary document see N79-22320 13-31)
Avail: NTIS HC A15/MF A01

In dual duct boxes, single duct boxes, and single duct units these specifications are included: casing leakage; damper leakage; minimum inlet static pressure; volume control; temperature mixing efficiency; and acoustical testing. Temperature control, humidity control, maintenance, operating costs, cleanliness, and odor control are discussed in the design objective for comfortable installation. S.E.S.

N79-22328# National Bureau of Standards, Washington, D. C. Center for Fire Research.
FIRE SAFETY GUIDELINES FOR VEHICLES IN A DOWNTOWN PEOPLE MOVER SYSTEM Final Report
Richard D. Peacock Jan. 1979 58 p refs Prepared for Urban Mass Transportation Admin.
(NBSIR-78-1586) Avail: NTIS HC A04/MF A01

The results of a study to formulate fire safety guidelines to be required for vehicles used in Downtown People Mover (DPM) systems for the movement of people in a congested urban area are presented. Through a review of the design features of existing people mover vehicles and systems, and a review of proposed new systems, fire scenarios are developed and guidelines suggested to minimize the fire risk to passengers. Methods and criteria, based on established test procedures, are proposed for assessing the flammability and smoke generation of interior finish furnishing materials. An extensive bibliography of flammability in fixed guideway transit systems is included. Author

N79-22329# Maryland Univ., College Park. Fire Protection Curriculum.
A THEORETICAL RATIONALIZATION OF A GOAL-ORIENTED SYSTEMS APPROACH TO BUILDING FIRE SAFETY
Jack Watts 28 Feb. 1979 265 p refs Sponsored in part by HEW
(Grant NBS-7-9007)
(NBS-GCR-79-163) Avail: NTIS HC A12/MF A01

The GSA approach is described and analyzed and a more scientific procedure by synthesizing GSA concepts with additional probability theory is formulated. Discussion of systems analysis and modeling concepts emphasizes the need for probabilistic considerations of fire safety. The revised model simplifies data requirements through parameter estimation techniques. The approach is consistant with the GSA model for several example cases. A demonstrated advantage of the methodology is the facility for sensitivity analysis of alternative fire protection strategies. G.Y.

N79-22330# ARMM Consultants, Inc., Gloucester, N. J.
MOISTURE PROBLEMS IN BUILDINGS Final Report
Robert J. Moore and Lawrence G. Spielvogel Dec. 1978 250 p refs
(Contract N62467-76-C-0696)
(AD-A064768) Avail: NTIS HC A11/MF A01 CSCL 13/8

This report is the result of an investigative study of moisture problems in air conditioned buildings in humid climates, specifically, enlisted quarters in Hawaii, Guam, and the Philippines. The object was to: (a) Identify the major types of building construction and types of environmental conditioning systems which contribute to moisture condensation, humidity, and mildew problems during the cooling season for sub-tropical and tropical environments, (b) Investigate the type of buildings and systems found in (a) and determine the contributing factors and (c) Develop recommended design practices and corrective measures required to preclude moisture condensation, humidity, and mildew problems. Author (GRA)

N79-22331# Army Military Personnel Center, Alexandria, Va.
STRENGTH OF TENSION LAP SPLICES IN POLYMER CEMENT CONCRETE Final Report M.S. Thesis - Colo. Univ., Boulder
William F. Vanaskie 8 May 1978 122 p refs
(AD-A064647) Avail: NTIS HC A06/MF A01 CSCL 11/2

For the past 30 years an area of major concern to engineers has been the strength of spliced reinforcement in reinforced concrete construction. This investigation used an epoxy emulsion to form a polymer-portland-cement concrete (PPCC), which was cast around tension lap splices in reinforced concrete beams. The beams, with varying length of lap splice, were tested with the splice located in a constant moment zone. The results showed that the strength of the splice can be increased by as much as 50 percent in ultimate load carrying capacity by use of the PPCC. Calculations also indicate that the required development length of the reinforcing steel in the PPCC is approximately one-half of that in ordinary concrete. These conclusions do not reflect, however, the physical properties of the material. Although the test beams acted favorably, the tensile strength of the PPCC at age seven days was 602 psi (42.3 Kg/sq cm), which was only a 3 percent increase over the cement concrete. However, the average bond stress was calculated to have an average increase of 200 psi over the cement concrete. The PPCC exhibited a failure pattern which allowed the ductility of the member, even at short splice lengths, to be superior to that of the control beams. The investigation indicates that this type of construction can readily be adapted to field use without additional costs in labor and with a savings in time and steel over other types of polymer modified concrete. Author (GRA)

N79-22332# Department of Energy, Washington, D. C. Div. of Industrial Conservation.
INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENT PROGRAM Annual Report
Jun. 1978 35 p
(DOE/CS-0033/1) Avail: NTIS HC A03/MF A01

The program includes the identification and ranking of the major energy-consumptive manufacturing industries (on the basis of 2-digit SIC codes), the establishment of energy efficiency improvement targets for at least the 10 most energy-consumptive industries, the identification of major energy-consumptive corporations within those industries for the purpose of determining those which must report progress in improving energy efficiency, and the establishment of a reporting system. A tabulation of the final target, at the two-digit SIC level, for the 10 most energy-intensive industries shows for the food and kindred products, 12%; textile mill products, 22%; paper and allied products, 20%; chemical and allied products, 14%; petroleum and coal products, 12%; stone, clay and glass products, 16%; primary metal ndustries, 9%; fabricated metal products, 24%; machinery, except electrical, 15%; and transportation equipment, 16%. DOE

N79-22333# National Technical Information Service, Springfield, Va.
SUPERFLUIDITY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1979
Brian Carrigan Mar. 1979 172 p Supersedes NTIS/PS-78/0242; NTIS/PS-77/0249 and NTIS/PS-76/0199
(NTIS/PS-79/0182/0; NTIS/PS-78/0242; NTIS/PS-77/0249; NTIS/PS-76/0199) Avail: NTIS HC $28.00/MF $28.00 CSCL 20M

The cited reports discuss superfluidity in liquid helium, with both helium 3 and helium 4 considered. Topics discussed include phase studies, heat transfer, hydrogynamics, rotons, zero sound, first sound, second sound, third sound, and fourth sound. GRA

N79-22334# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.
EARTHQUAKE RESPONSE OF BURIED PIPELINES (SEISMIC VULNERABILITY, BEHAVIOR AND DESIGN OF UNDERGROUND PIPING SYSTEMS)
Michael J. Rourke and Leon Ru-Liang Wang Mar. 1978 17 p refs
(Grant NSF ENV-76-14884)
(PB-291412/5; NSF/RA-780340; TR-4) Avail: NTIS HC A02/MF A01 CSCL 13B

The adequacy and vulnerability of water/sewer distribution systems subjected to seismic loads were investigated. Design methodologies for water/sewer systems were also studied. J.M.S.

N79-22335# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.
SEISMIC RESPONSE BEHAVIOR OF BURIED PIPELINES (SEISMIC VULNERABILITY, BEHAVIOR AND DESIGN OF UNDERGROUND PIPING SYSTEMS)
Kwong-Man Cheng Jun. 1978 16 p refs
(Contract NSF ENV-76-14884)
(PB-291413/3; NSF/RA-780341; TR-5) Avail: NTIS HC A02/MF A01 CSCL 13B

Pipeline damages caused by earthquake excitations in the longitudinal direction of a pipeline were observed to be a major mode of failure. A simplified quasi-static seismic deformation analysis neglecting the dynamic terms for buried pipelines subjected to earthquake motions in the axial direction is proposed. Using this model, parametric studies involving soilpipe interaction parameters, time delay of the traveling seismic waves, soil variations along the pipeline, end conditions, and variation of the seismic wave form are performed. Results obtained indicate the the delay time of seismic waves and the non-uniformity of soil resistance have much greater effects on the response behavior of buried pipelines than other parameters. GRA

N79-22336# Florida Dept. of Transportation, Gainesville.
LABORATORY PAVEMENT POLISHING DEVICE (WEAR MACHINE) VS. FIELD FRICTION TEST UNITS. PHASE 1: CORRELATION STUDY Final Report, 1968 - 1978
H. F. Godwin and R. L. McNamara Sep. 1978 29 p refs Sponsored by DOT
(PB-291374/7; RR-205; FHWA/RD-79-S0795) Avail: NTIS HC A03/MF A01 CSCL 13B

The description, fabrication, and initial operation of the Florida Department of Transportation's Laboratory Pavement Polarehing Device are reported. This device was developed to expand Florida's skid resistance program by providing a laboratory

method capable of determining aggregate wear with regard to asphalt concrete mixes. Results of this evaluation show a good correlation of wear numbers obtained with the Laboratory Pavement Polishing Device and field friction numbers obtained with the Friction Test Unit. Based on the favorable results in this report, Phase 2 will be initiated as a new HPR Study in an effort to determine the degree of polish that will occur when the pavement surfaces are subjected to varying traffic densities. GRA

N79-22337# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.

SEISMIC DESIGN CRITERIA FOR BURIED PIPELINES. (SEISMIC VULNERABILITY, BEHAVIOR AND DESIGN OF UNDERGROUND PIPING SYSTEMS)

Leon Ru-Liang Wang and Raymond Chong-Yu Fung Sep. 1978 23 p refs

(Grant NSF ENV-76-14884)

(PB-291415/8; NSF/RA-780343; TR-8) Avail: NTIS HC A02/MF A01 CSCL 13B

To evaluate the failure of buried pipelines consisting of nonhomogeneous materials under a bi-axial stress state, a modified Von-Mises failure criterion is proposed. The reserve strengths of a typical cast iron (rigid) pipe and a typical ductile iron (flexible) pipe with several important parameters such as aging (corrosion effect), laying and loading conditions, buried depth, dynamic effect, and trench load uncertainty factor in estimating vertical earth and truck loads is evaluated. It is concluded that the seismic reserve axial strength of buried pipes is influenced by all the parameters investigated. GRA

N79-22338# California State Dept. of Transportation, Sacramento. Transportation Lab.

CALCULATING EARTHWORK FACTORS USING SEISMIC VELOCITIES Final Report

Elgar Stephens Aug. 1978 56 p

(PB-291699/7; FHWA/CA/TL-78/23) Avail: NTIS HC A04/MF A01 CSCL 13B

Two new curves were developed for volcanic rocks; one for hard flow rock, and one for pyroclastics. Three highway projects constructed through sedimentary rocks were studied to determine if their earthwork factors could be correctly determined from the curve developed by a previous research study. The factors from construction on two of these projects were lower than factors estimated from the curve. The factor from the third project was higher than the curve indicated it should be. The curve was adjusted slightly to give a reasonable fit with the two projects plus the original study project. The third project was considered to represent a different material condition, and a new curve was developed that applied only to it. GRA

N79-22339# California State Dept. of Transportation, Sacramento. Div. of Structures.

BRIDGE DECK RESTORATION METHODS AND PROCEDURES. PART 3: EXPOSED MEMBRANE SEALS ON BRIDGE DECKS Interim Report

P. J. Jorach and I. R. Aarset Jul. 1978 91 p refs

(PB-291524/7; FHWA/CA/SD-77/15-Pt-3; IR-4; Rept-627120) Avail: NTIS HC A05/MF A01 CSCL 13B

Some 25 installations of bridge deck exposed membrane seals are evaluated. Each installation is discussed in detail and a test performance record for each is included. Each installation is rated as acceptable or not acceptable. All installations of one membrane type are collectively evaluated as to the suitability of that membrane for contract useage or for further testing. All California Standard Specification epoxy installations are evaluated as failures. A proprietary epoxy asphalt chip seal is rated as a failure in 3 test installations due to porosity, although aggregate retention was good. A proprietary urethane is rated as a failure in 4 test installations due to porosity and poor aggregate retention with one installation debonding extensively from the deck. Another proprietary urethane (PRC 445/440) is rated as a fully successful exposed membrane and is recommended for contract use. GRA

N79-22340# Kentucky Bureau of Highways, Lexington. Div. of Research.

SEASONAL VARIATIONS IN THE SKID RESISTANCE OF PAVEMENTS IN KENTUCKY

James L. Burchett Jul. 1978 73 p

(PB-290550/3; Rept-499) Avail: NTIS HC A04/MF A01 CSCL 13B

Frequent measurements of skid resistance were made on 20 pavements in common use in Kentucky. Principal analysis involved relating changes in skid resistance to day of the year and relating skid resistance to temperature at the time of test, to average antecedent temperatures, and to average rainfall. Seasonal variations exhibited an annual, sinusoidal cycle. The changes in sand-asphalt and bituminous concrete under higher volumes of traffic were about 12 skid numbers. The changes in portland cement concrete and bituminous concrete under lower volumes of traffic were about 5 skid numbers (SN's) occurred in early to mid-August for portland cement concrete and sand-asphalt pavements and in late August to early September for bituminous concrete. GRA

N79-22341# National Bureau of Standards, Washington, D. C. Center for Fire Research.

ANNUAL CONFERENCE ON FIRE RESEARCH Final Report

Clayton Huggett, ed. Dec. 1978 217 p refs Conf. held at Gaithersburg, Md., 27-29 Sep. 1978

(PB-291930/6; NBSIR-78-1526) Avail: NTIS HC A10/MF A01 CSCL 13J

Extended abstracts of grants and contracts for fire research sponsored by the Center for Fire Research, National Bureau of Standards and descriptions of the internal programs of the Center for Fire Research are presented. GRA

N79-22342# Bureau of Mines, Washington, D. C.

SAND AND GRAVEL Report on Mineral Commodity Profiles

James R. Evans Sep. 1978 28 p refs

(PB-289802/1; BM-MCP-23) Avail: NTIS HC A03/MF A01 CSCL 13C

Sand and gravel are, and will continue to be, among the most important construction and industrial materials in the United States. It is the only mineral commodity produced in all 50 States. It is the principal ingredient in many houses, office buildings, highways, dams, airport runways, bridges, canals, and in glass for bottles and house and automobile windows. Also, it has one of the lowest average per ton values of all mineral commodities. To keep the price of sand and gravel low, the general trend is toward larger, more efficient plants, working larger deposits, and keeping the transportation costs to deliver a ton of aggregate at a minimum. This Bureau of Mines report presents comprehensive data on sand and gravel including industry structure, reserves-resources, technology, supply-demand relationships, byproducts and coproducts, economic factors and problems, operating factors and problems, and outlook to 2000. GRA

N79-22343# Missouri State Highway Dept., Jefferson City. Div. of Materials and Research.

A STUDY OF DETERIORATION IN CONCRETE BRIDGE DECKS Final Missouri Cooperative Highway Research Program

Apr. 1978 92 p

(PB-291937/1; MCHRP-62-1; FHWA/MO-62/1) Avail: NTIS HC A05/MF A01 CSCL 13B

Seven phases of study related to the problem of bridge deck deterioration are reported. The variables include timing variations for completion of hauling and finishing deck concrete, concrete test variations, and weather variations; an increase in depth of cover over the top reinforcing steel from 1 1/2 to 2 inches; insulating the underside of a bridge deck; sealing different areas of a bridge deck with one and five applications of linseed oil and with one application of a penetrating epoxy sealer; using an admixture in bridge deck concrete; evaluation of various field applied waterproofing membranes for effectiveness in protecting bridge decks (some of these membranes are no longer available); and determining chloride content of concrete from bridge decks with asphaltic concrete overlays with and without protective membrane systems. GRA

N79-22344# New York State Dept. of Transportation, Albany. Engineering Research and Development Study.

BOX-GIRDER BRIDGE ANALYSIS: A MODEL STUDY Final Report
James A. Sanford Oct. 1978 25 p refs
(PB-291772/2; FHWA/NY-78-SR59) Avail: NTIS HC A02/MF A01 CSCL 13B

Experimentally determined responses of plexiglass models of steel two- and three-girder box-girder bridges with various support skew angles under static live-load conditions are compared with a theoretical analysis representing the structure as a planar grid. The model structures evaluated were small, having span lengths less than 10 ft. Test measurements consisted of strains and deflections. The results show that the planar-grid analysis with properly specified member properties is a reliable analytical tool for checking box-girder bridge designs. Theoretical values are shown to be conservative and adequately to predict transverse distributions of the loads. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N79-22345 Committee on Commerce, Science, and Transportation (U. S. Senate).
INTERNATIONAL MARITIME SATELLITE TELECOMMUNICATIONS
Washington GPO 1978 159 p refs Hearing on S. 2211 and H.R. 11209 before the Subcomm. on Communications of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 2d Sess., 8 May 1978
(GPO-30-338) Avail: Subcomm. on Communications

The Senate hearings are reported concerning the U.S. participation in the International Maritime Satellite Organization. The structure and activities of communication satellite corporations, and public maritime coast stations services are discussed. F.O.S.

N79-22346 Duke Univ., Durham, N. C.
ADAPTIVE LINEAR ESTIMATION ALGORITHMS APPLIED TO SPECTRAL LINE ENHANCEMENT Ph.D. Thesis
Stephen Doyle Huffman 1978 328 p
Avail: Univ. Microfilms Order No. 7906978

In this dissertation, two adaptive algorithms based on fixed point iteration methods and using direct estimates of the required statistics are proposed. These algorithms are slightly more complex than the LMS Gradient Algorithm but have the advantage that the amount of computational effort required during each sample period can be varied. Thus, tradeoffs can be made between the number of operations required per sample and the rate of convergence of the algorithm. The performance characteristics of the LMS Gradient Algorithm, two Adaptive Fixed-Point Iteration Algorithms and of a non-iterative method based on Levinson's Algorithm are considered for the case where an adaptive algorithm is used to determine the unit sample response for a system which attempts to discriminate between the signal and noise processes on the basis of bandwidth. Such a system is often referred to as a Spectral Line Enhancer. Theoretical bounds on the mean square error as a function of the time index n are derived for each of the three iterative methods. Dissert. Abstr.

N79-22347* National Aeronautics and Space Administration. Pasadena Office, Calif.
REDUNDANT RF SYSTEM FOR SPACE APPLICATION Patent
Charles W. Rook, inventor (to NASA) (Motorola, Inc., Scottsdale, Ariz.) Issued 3 Apr. 1979 7 p Filed 11 Jul. 1977 Supersedes N77-28358 (15 - 19, p 2520) Sponsored by NASA
(NASA-Case-NPO-13955-1; NASA-Case-NPO-13956-1; NASA-Case-NPO-13957-1; US-Patent-4,147,980; US-Patent-Appl-SN-814813; US-Patent-Class-325-24; US-Patent-Class-343-176; US-Patent-Class-343-180; US-Patent-Class-333-206; US-Patent-Class-325-366) Avail: US Patent and Trademark Office CSCL 17B

An S-band radio frequency subsystem is described including two transmitters, two receivers and two antennas. The subsystem is capable of connecting either transmitter or receiver to either antenna while permitting simultaneous operation of a transmitter and a receiver. Circulator switches provide selection of a specific transmitter and receiver for connection to either a high gain or low gain antenna. Transmitter output filters, receiver input filters, and diplexers are combined to prevent radiation or coupling or unwanted transmitter and receiver signals and to provide isolation, permitting simultaneous operation of the transmitter and receiver. The filter elements are designed of constant diameter coaxial elements to meet demanding rejection, loss, power-handling and environmental characteristics. Official Gazette of the U.S. Patent and Trademark Office

N79-22348 British Broadcasting Corp., Kingswood (England). Research Dept.
A COMPUTER-BASED MIXING AND FILTERING SYSTEM FOR DIGITAL SOUND SIGNALS
G. W. McNally Mar. 1979 17 p refs
(BBC-RD-1979/4) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The use of digital techniques to implement the processing found in conventional analogue mixing desks of the kind used for the mix-downs of multi-channel audio recordings is described. The various problems were investigated individually using a small, high speed computer controlled by a stored program. The experimental equipment did not have sufficient power to perform all the processing required, but a factor of three improvement permits all the functions in one channel of a fully equipped mixing desk to be performed digitally. M.M.M.

N79-22349# Royal Aircraft Establishment, Farnborough (England).
AN ULTRA-WIDEBAND ANTENNA
I. T. Ivanov Dec. 1978 7 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (USSR), V. 13, No. 1, 1970 p 74-76
(RAE-Lib-Trans-2005; BR67147) Avail: NTIS HC A02/MF A01

A size-reduced ultra-wideband three-element antenna is described. Each resonator element is a half-wave dipole, tuned to long, medium and short wave points in the frequency band, respectively. Size reduction of the dipoles is effected by employing a slow-wave helical structure wound coaxially on an insulated tube. The helices are short-circuited at their outer ends to achieve broadbanding. The reported match of this antenna over 4-5 octaves is 1.5 VSWR. Author

N79-22350*# Hughes Aircraft Co., Culver City, Calif. Radar Systems Group.
SHUTTLE MILLIMETER WAVE COMMUNICATIONS EXPERIMENT (MWCE) ANTENNA SYSTEM DEVELOPMENT Antenna System Requirements Report
Mar. 1978 65 p
(Contract NAS5-24277)
(NASA-CR-159920; P78-281) Avail: NTIS HC A04/MF A01 CSCL 17B

An antenna system requirements report is presented. Topics reported include: (1) antenna system specifications; (2) waveguide circuitry; (3) feed horn design; (4) dish reflectors; (5) gimbal systems; and (6) summary of system design. G.Y.

N79-22351# Defense Communications Engineering Center, Reston, Va.
SENET SIMULATOR USER'S GUIDE
D. Castello Sep. 1978 76 p refs
(AD-A064590; AD-E100164; DCEC-TN-24-78) Avail: NTIS HC A05/MF A01 CSCL 17/2

This TN classifies the frame allocation techniques which may be used with the circuit-switched and packet-switch integration technique called the Slotted Envelope Network (SENET) concept. It describes a program written in a dialect of the Simulation Oriented Language, SOL-370 Rel 1-79, which simulates a class of the SENET allocation techniques. Example runs of the simulation, statistic, and plot programs are included. A simple

three state speech activity model is derived in the appendix.
Author (GRA)

N79-22352# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELECTRICAL ENGINEERING DIGITAL DESIGN LABORATORY COMMUNICATIONS NETWORK, PART 3 M.S. Thesis
Donald L. Ravenscroft Dec. 1978 52 p refs
(AD-A064633; AFIT/GCS/EE/78-16-Pt-3) Avail: NTIS HC A04/MF A01 CSCL 17/2

This manual provides instructions on how to operate the CYBER System Computer Program (CYBERSCP). The primary purpose of the CYBERSCP is to provide a software interface that allows direct transfer of user created data files between the Altair 8800b minicomputer and the ASD/AFIT CDC CYBER 74 computer. The CYBERSCP also provides the capability to execute SCOPE commands using the CYBER 74 INTERCOM System. The CYBERSCP is composed of five computer programs implemented on the Altair 8800b computer in the Electrical Engineering Digital Engineering Laboratory. The five programs are: (1) DOSCYB, (2) CYBER, (3) CIN3, (4) BASIC and (5) TIME. All of these programs working together establish and maintain the CYBER 74 to Altair data interface. GRA

N79-22353# Rome Air Development Center, Griffiss AFB, N.Y.
ON HIGH-FREQUENCY IONOSPHERIC DUCTING: A REVIEW
Kurt Toman Sep. 1978 20 p refs
(AF Proj. 2305)
(AD-A063873; RADC-TR-78-206) Avail: NTIS HC A02/MF A01 CSCL 20/14

The observational evidence for long-range propagation of high-frequency radio signals began to accumulate in 1926 when transatlantic communication links had been established. In 1927, signals were detected that had propagated over large distances or circled the earth with little attenuation. LONG-RANGE AND ROUND-THE-WORLD (RTW) signals showed preferred periods of occurrence. Relatively high angles of incidence (20 deg relative to the horizontal) of such signals at the receiver, paired with low attenuation, ruled out conventional multihop propagation. An ionospheric refractive index boundary was postulated along which the signal propagates in a glancing-incidence low-loss mode. The transmission path of observed long-delayed signals, originating from artificial earth satellites, was found to be located in the twilight zone. Experiments using ground-based transmissions confirmed the role of ionospheric absorption and tilts for the occurrence of long-range and RTW signals. Detailed explanations for ionospheric ducting were provided using several theoretical concepts and analyses. The (mu)(r) (refractive index times geocentric distance) - diagram was used for the study of ray propagation in a spherically stratified multi-layered model ionosphere depicting characteristics of the ground-detached glancing-incidence mode. Numerical ray-tracing computations were made using model ionospheres with horizontal gradients.
GRA

N79-22354# Ohio State Univ., Columbus. Electroscience Lab.
ASYMPTOTIC HIGH FREQUENCY TECHNIQUES FOR UHF AND ABOVE ANTENNAS Annual Report, 1 Aug. 1977 - 31 Jul. 1978
R. C. Rudduck, R. J. Marhefka, W. D. Burnside, R. G. Koyuoumjian, and C. H. Walter Oct. 1978 100 p refs
(Contract N00123-76-C-1371)
(AD-A063870; ESL-4508-12; ESL-784508) Avail: NTIS HC A05/MF A01 CSCL 09/5

The overall scope of the program on Contract No. N00123-76-C-1371 between The Ohio State University Electro Science Laboratory and the Naval Electronics Laboratory Center is to develop the necessary theory, algorithms and computer codes for simulating antennas at UHF and above in a complex ship environment. The work consists of (a) basic scattering code development, (b) reflector antenna code development and (c) basic studies to support items (a) and (b). This report describes the progress in each of these three areas for the period 1 August 1977 to 31 July 1978. Author (GRA)

N79-22355# Raytheon Co., Bedford, Mass. Missile Systems Div.
DUAL FREQUENCY ARRAY TECHNIQUES EXPERIMENTAL STUDY Final Technical Report, Feb. 1977 - Jan. 1978
Jerome H. Pozgay Aug. 1978 45 p refs
(Contract F19628-77-C-0112)
(AD-A063820; BR-10222; RADC-TR-78-178) Avail: NTIS HC A03/MF A01 CSCL 09/5

An experimental investigation of the twin slab dual frequency array element and low frequency element exciter is presented. Principal plane radiation patterns of the center element of a 23 element array are presented. It is shown that in the low frequency operating bands (4 GHz), the principal plane element patterns are synonymous with realized gain patterns reported previously. However, in the high frequency band (8 GHz), neither individual phase center patterns nor fully excited element patterns bear the normal relation to realized gain. In particular, array scan characteristics must be constructed by summing individual phase center pattern without the standard array factor exponential weighting. A novel coax-fed notch exciter for low frequency band operation has been developed empirically. The exciter provides greater than 20 dB band isolation over most of the 16 percent band centered at 8 GHz, and better than 1.9:1 VSWR over the 4 GHz band. Author (GRA)

N79-22356# Harry Diamond Labs., Adelphi, Md.
THE GENERATION OF HIGH-POWER MICROWAVE RADIATION FROM INTENSE RELATIVISTIC ELECTRON BEAMS
R. Alan Kehs and Alan Bromborsky Nov. 1978 25 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A063881; HDL-TM-78-20) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report provides a basis for evaluating the current and near-future development of relativistic-electron-beam (REB) technology for the generation of microwave radiation. Magnetrons, gyrotrons, and Raman scattering are examined in some detail and references are cited for several other conversion schemes. The status of repetitively pulsed REB generation is then reviewed and two hypothetical systems are constructed from the conversion schemes and generators that were considered earlier. Finally, some of the advantages (such as high power and compact size) and disadvantages (such as unproven technology) are summarized. Author (GRA)

N79-22357# Syracuse Univ., N. Y.
USER'S MANUAL FOR THE ANTENNA PATTERN DISTORTION COMPUTER PROGRAM, VERSION 4
J. Perini, S. Wang, and K. Hirasawa Jan. 1979 48 p refs
(Contract F30602-75-C-0121)
(AD-A064063; RADC-TR-78-263) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report is a step-by-step guide to the user of the Antenna Pattern Distortion Computer Program (DISTORT) which has been developed to analyze the coupling effects, the radiation pattern distortion, and the communication range of antennas mounted in close proximity. The program has been specially designed to analyze the installation of ground-to-air communication stations used by the Air Force. The program is written in a user oriented fashion making it extremely simple to use. GRA

N79-22358# Technology, Inc., Dayton, Ohio. Instruments and Controls Div.
ANALYTICAL AND EXPERIMENTAL VALIDATION OF THE LIGHTNING TRANSIENT ANALYSIS TECHNIQUE Final Report, Mar. - Nov. 1977
W. McCormick, K. J. Maxwell, and R. Finch Mar. 1978 200 p
(Contract F33615-75-D-0090)
(AD-A063991; AFFDL-TR-78-47) Avail: NTIS HC A09/MF A01 CSCL 20/14

A research program was undertaken to analyze and experimentally validate the Lightning Transient Analysis (LTA) technique using Lightning Simulation Test (LST) data. Using linear systems theory, the LST has been shown to be a linear combination of three transfer functions. These transfer functions were derived and shown to be valid. Specifically, the linear transform of the output pulse (S sub LST (Omega)) was shown to be the product

of linear transfer functions of the LST configuration (G sub LST (Omega)), an aperture coupling term (G sub ap (Omega)) and the aircraft wiring/measurement equipment (G sub a/c (Omega)). Recommendations are made to perform analytical and experimental studies to quantify configuration effects; small aperture spatial electromagnetic fields and shielding effects; the pulse response of a wide range of aircraft circuits; the complete nature of aperture coupling, including identification of the dominant and secondary apertures; the effects of possibly distributed versus local excitation points and methods of extending the technique to other aircraft cabling parameters (e.g., terminating impedances, non-linear devices and cable lengths) and to shielded cabling. The amplitude scaling technique should be incorporated into existing routines at the AFFDL Electromagnetic Hazards Group data acquisition and processing system. GRA

N79-22359# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.

ELECTROMAGNETIC COMPATIBILITY STUDY OF A PROPOSED NATO SATELLITE EARTH TERMINAL AT THE US NAVAL STATION, KEFLAVIK, ICELAND Field Measurement Report, 31 Aug. - 14 Oct. 1978

John L. Word Jan. 1979 52 p refs
(AD-A063811; CCC-EMEO-ECD-79-MR-48) Avail: NTIS HC A04/MF A01 CSCL 17/2

The results of on-site measurements and analysis are provided which evaluate the electromagnetic compatibility of a proposed NATO Satellite Earth Terminal with the environment at the US Naval Station, Keflavik, Iceland. It is concluded that all five candidate locations are satisfactory provided that downlink (receive) frequencies are selected in accordance with the guidance provided herein. A list of proposed downlink frequencies, provided by the NATO Integrated Communications System Management Agency, has been evaluated and is acceptable. Author (GRA)

N79-22360# Lincoln Lab., Mass. Inst. of Tech., Lexington.

IMAGING AND TARGET DETECTION WITH A HETERODYNE-RECEPTION OPTICAL RADAR

Jeffrey H. Shapiro 13 Oct. 1978 82 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A063767; TST-24; ESD-TR-78-275) Avail: NTIS HC A05/MF A01 CSCL 17/5

A theoretical study of the use of a heterodyne reception CO2 laser radar for imaging and target detection is reported. Specifically, a mathematical system model for the radar is developed, incorporating the statistical effects of propagation through atmospheric turbulence, target speckle and glint, and heterodyne-reception shot noise. This model is used to find the image signal-to-noise ratio of a matched-filter envelope detector receiver and the target-detection probability of the optimum likelihood-ratio processor. For realistic parameter values it is shown that turbulence-induced beam spreading and coherence loss may be neglected. Target speckle and atmospheric scintillation, however, present serious limitations on single-frame imaging and target detection performance. Author (GRA)

N79-22361# Itek Corp., Lexington, Mass. Optical Systems Div.

HYBRID OPTICAL/ELECTRONIC PROCESSOR STUDY Final Report

Bruce A. Horwitz Dec. 1978 61 p refs
(Contract DAAG29-77-C-0027)
(AD-A063929; PFR-78-105) Avail: NTIS HC A04/MF A01 CSCL 17/9

Itek Corporation has performed a three-part study that addresses the use of hybrid optical/electronic processing techniques for high range resolution imaging radar systems. The first part of the study was an investigation of the processing requirements of the HR-cubed system. Parametric evaluations were performed that related processor capabilities such as number of parallel processing channels to the basic system operating parameters such as cross-range resolution, target density, target range, and target velocity. The second part of this study included a survey of hybrid processing systems that have already been assembled. This survey covered illustrative examples of the different types of hybrid processors, including power spectrum analyzers, Fourier transform filtering systems and synthetic aperture radar processors. The third part of this study developed a strawman hybrid processor for HR-cubed image generation. In keeping with hybrid design philosophy, the system included optical subsystems for pulse compression, mass storage, Fourier transformation, and image correlation. GRA

N79-22362# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

RADAR CLUTTER EFFECTS IN A TARGET CLASSIFIER M.S. Thesis

Joseph M. Renaud Dec. 1978 72 p refs
(AD-A064180; AFIT/GE/EE/78-37) Avail: NTIS HC A05/MF A01 CSCL 17/9

A previously proposed algorithm for the classification of periodically amplitude modulated targets is studied for its possible use in an air-to-ground radar situation. The assumptions necessary for the use of the algorithm are discussed and the limitations and scope of the problem are presented. Classification probabilities of error are presented based on worst case analysis of clutter conditions in the received radar signal. Analysis is provided for a two class problem and a three class problem using both nearest neighbor rules and stepwise discriminant analysis for classification. The clutter in these problems is studied under conditions of spectral spreading and increased clutter signal power. The effect on probability of error is found to be small enough that there are definite possibilities for the use of this algorithm in some air-to-ground applications. Author (GRA)

N79-22363# Mathematical Applications Group, Inc., Elmsford, N. Y.

THE RADOT CODE FOR THE TRACKING OF RADAR INCIDENT ON TREES Final Report

M. O. Cohen and H. A. Steinberg Feb. 1978 40 p refs
(Contract DAAK70-77-C-0243; DA Proj. 4A1-61102-B-52C)
(AD-A063885; MAGI-MR-7058; ETL-0147) Avail: NTIS HC A03/MF A01 CSCL 17/9

A computer code, RADOT, was developed to track incident radar through forests consisting of realistically simulated trees. RADOT fires parallel radar rays at the simulated forest and records information for all materials intersected between the origin and the ground. This information includes type of object (branch, twig or leaf), its size and orientation parameters (components of normal or axis vector) and the depth. Radot has been successfully installed on the ETL CDC-6400 computer. Other versions, for IBM-360 or CDC-6600 computers are also available. Author (GRA)

N79-22364# Arizona Univ., Tucson. Engineering Experiment Station.

EXTERIOR-INTERIOR APERTURE COUPLING OF A RECTANGULAR CAVITY WITH WIRE OBSTACLE Annual Progress Report, 1 Oct. 1977 - 30 Sep. 1978

William Arthur Johnson 30 Nov. 1978 100 p refs
(Grant AF-AFOSR-3462-77)
(AD-A064587; AFOSR-79-0020TR) Avail: NTIS HC A05/MF A01 CSCL 20/3

In this work, the exterior-interior coupling problem of a cavity backed aperture in a perfectly conducting infinite sheet is considered. The cavity is assumed to be rectangular and contains a perfectly conducting obstacle. For numerical considerations the obstacle is taken to be a straight, thin wire, oriented perpendicular to one of the cavity walls. The problem is formulated in the frequency domain with an exp(i(omega)t) time dependence. The dyadic formulation of this vector electromagnetic boundary value problem is given. The controversy over the longitudinal wave functions and their contribution to field dyads is resolved. Specific attention is given to the singularities and completeness of the Green's dyads' eigenfunction expansions. Numerically tractable integral equations for the aperture electric fields are obtained. A summation method is developed for evaluation of otherwise slowly converging eigenfunction expansions of potential dyads when source and observation points become close. Suggestions for future extensions of this work are discussed. Author (GRA)

N79-22365# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

SIMULTANEOUS NON-HOMOGENEOUS MULTIPLE ACCESS TECHNIQUES M.S. Thesis

Pedro Rodriguez Dec. 1978 86 p refs
(AD-A064726; AFIT/GE/EE/78-39) Avail: NTIS HC A05/MF A01 CSCL 17/1

The possibility of using simultaneous non-homogeneous multiple access techniques through a common transponder channel was investigated. Three configurations were analyzed: (1) a single time division multiple access, (2) several frequency division multiple accesses, and (3) the combined accesses of configurations (1) and (2). Each of the configurations was studied in three disjoint segments: (1) the bandwidth and shape of the power spectrum for various modulating waveforms, (2) the probability for error for linear PSK and non-linear PSK systems, and (3) the distortion effects that a signal experiences through a non-linearity. Each segment was studied in detail independently of the others. The comprehensive analysis accomplished on each segment, when joined into a system, allows the end-to-end channel characterization. GRA

N79-22366# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

OBJECTIVE MEASURE OF SPEECH INTELLIGIBILITY USING LINEAR PREDICTIVE CODING M.S. Thesis

Donald M. Ottinger, Jr. Dec. 1978 61 p refs
(AD-A064727; AFIT/GE/EE/78-35) Avail: NTIS HC A04/MF A01 CSCL 17/2

Four distance measures of speech intelligibility based on linear predictive coding (LPC) are developed and evaluated. The data base used for evaluating the measures consisted of lists of 58 words from Diagnostic Rhyme Test 4. The lists were transmitted over a spread spectrum radio communications channel and subjected to 7 different levels of non-white, non-Gaussian jamming noise. The lists were all scored subjectively for intelligibility by a trained listener panel. The subjective scores were used to judge the effectiveness of the four distance measures. The Articulation Index was also calculated for each of the word lists and compared to the LPC measures as to effectiveness and efficiency in measuring speech intelligibility. The Articulation Index was significantly more effective than the LPC measures. The best LPC measure provided 42% correlation with the subjective scores. The Articulation Index provided 69% correlation. The overhead associated with data tape alignment and parameter computation makes LPC measures extremely inefficient as compared to the Articulation Index. Author (GRA)

N79-22367# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ELECTRICAL ENGINEERING DIGITAL DESIGN LABORATORY COMMUNICATIONS NETWORK, PART 1 AND 2 M.S. Thesis

Donald L. Ravenscroft Dec. 1978 241 p refs
(AD-A064729; AFIT/GCS/EE/78-16-Pt-1/2) Avail: NTIS HC A11/MF A01 CSCL 17/2

Four types of network routing algorithms were investigated as candidates for use in the proposed AFIT Electrical Engineering Digital Engineering Laboratory (DEL) network. The four types were deterministic, isolated, centralized and distributed. The advantages and disadvantages of each type of network routing algorithms were evaluated for possible use in the DEL network. The distributed routing algorithm was selected for the proposed DEL network because it was found to be more efficient and reliable. The educational benefits of the distributed routing algorithm were also discussed. In order to improve the distributed routing algorithm's response time to changes in the network topology and traffic flow and to reduce the algorithm's oscillation caused by changes in the network topology a technique known as 'hold down' was incorporated. A description of the routing algorithm, including this 'hold down' technique, is discussed in sufficient detail to permit implementation of the algorithm into the proposed DEL network. In addition to the description of the distributed routing algorithm, several types of communications protocols were investigated for use in the node-to-node network. The Advanced Data Communications Control Procedures and the Synchronous Data Link Control procedures were recommended for use in the proposed DEL network. GRA

N79-22368# Rockwell International Corp., Newport Beach, Calif. Collins Government Telecommunications Div.

DEMAND ASSIGNMENT TECHNIQUES STUDY (DATS) FOR MILITARY SATELLITE COMMUNICATION APPLICATIONS. VOLUME 1: EXECUTIVE SUMMARY Final Report

25 Jun. 1977 15 p refs
(Contract DCA100-76-C-0030)
(AD-A064348; Rept-523-0767775-00221M-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 17/2

This final report presents the results of the Demand-Assignment Techniques Study (DATS). The objective of this one-year study is to evaluate demand assignment (DA) techniques for military satellite communications. Demand-assignment provides an effective way to meet growing DOD requirements for satellite communications by enabling many users to share satellite and earth terminal resources. The study is divided into the following four major tasks; Establishment of Selection Criteria, Trade-off Investigation of candidate DA Techniques, Detailed Investigation of Preferred DA Techniques, and Evaluation of Earth Terminal Reliability and Cost. Results of all study task as well as overall conclusion and recommendations are presented. GRA

N79-22369# Rockwell International Corp., Newport Beach, Calif. Collins Government Telecommunications Div.

DEMAND ASSIGNMENT TECHNIQUES STUDY (DATS) FOR MILITARY SATELLITE COMMUNICATION APPLICATIONS. VOLUME 2 Final Report

25 Jun. 1977 293 p refs
(Contract DCA100-76-C-0030)
(AD-A064349; Rept-523-0767775-00221M-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 17/2

Volume 2 of a two volume report is presented. This volume contains the main body of the report plus technical appendixes. The objective of the study was to identify, investigate, and rank candidate demand-assignment techniques for both SHF and UHF military satellites communication applications. The highest ranked candidates are those demand-assignment techniques that provide an acceptable grade of service to all users in the most cost effective manner while providing the optimum utilization of the available satellite resources. G.Y.

N79-22370# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE APPLICATION OF SURFACE ACOUSTIC WAVE TECHNOLOGY TO COMMUNICATIONS SYSTEMS M.S. Thesis

Daniel T. Heale Dec. 1978 77 p refs
(AD-A064387; AFIT/GE/EE/78-25) Avail: NTIS HC A05/MF A01 CSCL 17/2

The purpose of this study is to suggest new approaches to the use of surface acoustic wave technology in communications systems. The problem was approached by considering the basic physics of the waves and their interactions with themselves, the electrons, and with photons. Three devices that used SAW components were analyzed on the basis of the basic physics, and their performance was compared with non-SAW devices, where possible. The three devices were a SAW convolver with bidirectional amplification, an A/D converter using a SAW-generated reference waveform, and a phase-lock loop using acoustic waves for the mixing and filtering functions. Based on the analysis of those devices, new approaches are suggested. The devices suggested were a mixer that delays one input relative to a second input; a variable Q, high Q bandpass filter; and a filter that selects a signal based on an impurity pattern in a semiconductor. Author (GRA)

N79-22148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

MULTIPATH EFFECTS ON THE TIME DELAYS OF MICROWAVE CASSEGRAINIAN ANTENNAS

T. Y. Otoshi and W. V. T. Rusch (University of Southern California) *In its* The Deep Space Network 15 Apr. 1979 p 52-55 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N79-22152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPECTRAL SHAPING WITHOUT SUBCARRIERS

L. R. Welch (University of Southern California) *In its* The Deep Space Network 15 Apr. 1979 74-76 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N79-22155*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NOTE ON DIGITAL SIGNATURES
R. J. McEliece (Illinois Univ.) *In its* The Deep Space Network 15 Apr. 1979 p 95-96 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-22162*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIDEBAND DATA ERROR RATES
J. P. McClure *In its* The Deep Space Network 15 Apr. 1979 p 156-160 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-22164*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DOMSAT CW TRANSMISSION BENT PIPE INVESTIGATION: INITIAL PHASE NOISE MEASUREMENTS VIA RCA SATCOM LINK
M. H. Brockman and C. E. Jones *In its* The Deep Space Network 15 Apr. 1979 p 181-188 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-22165*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN VHF TRANSMITTING ARRAY BACKUP COMMAND UPLINK FOR VOYAGER 2
R. M. Dickinson *In its* The Deep Space Network 15 Apr. 1979 p 189-195 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-22167*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO FREQUENCY CARRIER ARRAYING
R. Lay *In its* The Deep Space Network 15 Apr. 1979 p 206-215 ref (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-22371 Wisconsin Univ. - Madison.
SLIP AND VOLT/HERTZ CONTROL OF INDUCTION MACHINES Ph.D. Thesis
Arturo Ricardo Miles 1978 189 p
Avail: Univ. Microfilms Order No. 7823754

An approximate model, in both the constant slip and the volt/hertz schemes which allows for direct entry to the generalized root loci is described. The parameters are normalized in a way that most machines can be analyzed by reading the coordinates on the generalized root loci curves. Dissert. Abstr.

N79-22372 Michigan Univ., Ann Arbor.
FREQUENCY CONVERSION IN PUNCH-THROUGH SEMICONDUCTOR DEVISES Ph.D. Thesis
Patrick James McCleer 1978 270 p
Avail: Univ. Microfilms Order No. 7907132

An analytic large-signal model for the barrier injection transit time (BARITT) diode is developed based on the nonlinear exponential injection mechanism. Excellent agreement is obtained when the results of this simple model are compared with the results of higher order numerical studies and to experimental results. Extension of the model to include harmonic power extraction is also demonstrated. BARITT diode frequency converters are examined in two fundamentally different studies, based on two different methods of analysis. The minimum detectable signal of the very low IF mixer is shown to be comparable to the AM noise of the diode oscillator itself and the optimum noise figure of the general mixer is shown to be comparable, particularly at millimeter wavelengths, to that obtainable from the best present day Schottky-barrier diode mixers. Dissert. Abstr.

N79-22373* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DIGITAL AUTOMATIC GAIN AMPLIFIER Patent
Larry D. Holley and James O. Ward, inventors (to NASA) (Federal Electric Corp., Paramus, N.J.) Issued 22 Aug. 1978 5 p Filed 24 Mar. 1977 Supersedes N77-21321 (15 - 12, p 1577)
(NASA-Case-KSC-11008-1; US-Patent-4,109,213; US-Patent-Appl-SN-780729; US-Patent-Class-330-2; US-Patent-Class-324-99D; US-Patent-Class-324-123C; US-Patent-Class-330-51; US-Patent-Class-330-86) Avail: US Patent and Trademark Office CSCL 09A

A circuit is described for adjusting the amplitude of a reference signal to a predetermined level so as to permit subsequent data signals to be interpreted correctly. The circuit includes an operational amplifier having a feedback circuit connected between an output terminal and an input terminal; a bank of relays operably connected to a plurality of resistors; and a comparator comparing an output voltage of the amplifier with a reference voltage and generating a compared signal responsive thereto. Means is provided for selectively energizing the relays according to the compared signal from the comparator until the output signal from the amplifier equals to the reference signal. A second comparator is provided for comparing the output of the amplifier with a second voltage source so as to illuminate a lamp when the output signal from the amplifier exceeds the second voltage.

Official Gazette of the U.S. Patent and Trademark Office

N79-22374*# Texas Instruments, Inc., Dallas.
ELECTROSTATICALLY FOCUSED INTENSIFIED CHARGE COUPLED DEVICES Final Technical Report, 8 Jul. 1976 - 8 Jul. 1977
James W. Walker Aug. 1977 88 p refs
(Contracts NAS5-23578; DAAG53-75-C-0191)
(NASA-CR-159925) Avail: NTIS HC A05/MF A01 CSCL 09A

Work performed to develop intensified charge coupled devices (ICCDs) is presented. Four ICCDs, containing 100 x 160 arrays, were fabricated. Electron gains up to 3200 at 15 keV were achieved. Photocathode sensitivities ranged from 190 to 410 micro A/lumen. Dark currents varied from 11 nA/sq cm to 37 nA/sq cm. There was serious concern about the reliability of the bonding scheme for ICCDs due to occassional bond failure. Two solutions to this problem were developed. One involved a modification of the existing bonding technique, and the other was the development of a protected bond pad employing a barrier metal between the aluminum metallization and the gold bond wire. An accumulation process was characterized with respect to its most critical variable. This characterization led to the achievement of reproducible spectral response and the discovery and elimination of dark current increase associated with this process. G.Y.

N79-22375*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL PREDICTION WITH MULTIDIMENSIONAL COMPUTER PROGRAMS AND EXPERIMENTAL VERIFICATION OF THE PERFORMANCE, AT A VARIETY OF OPERATING CONDITIONS, OF TWO TRAVELING WAVE TUBES WITH DEPRESSED COLLECTORS
James A. Dayton, Jr., Henry G. Kosmahl, Peter Ramins, and Norbert Stankiewicz May 1979 28 p refs
(NASA-TP-1449; E-9728) Avail: NTIS HC A03/MF A01 CSCL 09A

Experimental and analytical results are compared for two high performance, octave bandwidth TWT's that use depressed collectors (MDC's) to improve the efficiency. The computations were carried out with advanced, multidimensional computer programs that are described here in detail. These programs model the electron beam as a series of either disks or rings of charge and follow their multidimensional trajectories from the RF input of the ideal TWT, through the slow wave structure, through the magnetic refocusing system, to their points of impact in the depressed collector. Traveling wave tube performance, collector efficiency, and collector current distribution were computed and the results compared with measurements for a number of TWT-MDC systems. Power conservation and correct accounting of TWT and collector losses were observed. For the TWT's

operating at saturation, very good agreement was obtained between the computed and measured collector efficiencies. For a TWT operating 3 and 6 dB below saturation, excellent agreement between computed and measured collector efficiencies was obtained in some cases but only fair agreement in others. However, deviations can largely be explained by small differences in the computed and actual spent beam energy distributions. The analytical tools used here appear to be sufficiently refined to design efficient collectors for this class of TWT. However, for maximum efficiency, some experimental optimization (e.g., collector voltages and aperture sizes) will most likely be required. Author

N79-22376# Texas Instruments, Inc., Dallas. Central Research Labs.

MONOLITHIC INTEGRATION OF MICROWAVE Ga-As POWER FETs Annual Technical Report, 1 Oct. 1977 - 30 Sep. 1978

V. Sokolov, R. E. Williams, and D. W. Shaw Oct. 1978 53 p refs

(Contract N00014-77-C-0657; RF54581001)

(AD-A062294; TI-08-78-46) Avail: NTIS HC A04/MF A01 CSCL 09/5

Monolithic integration of GaAs power field effect transistors (FETs) at X-band microwave frequencies is investigated. Incorporation of on-the-chip matching using lumped elements and coplanar ground metallization is investigated for monolithic FET device design. Coplanar microstrip transmission lines fabricated on alumina substrates are used to interface with the GaAs chips. Microstrip to coplanar microstrip transitions are also incorporated on the alumina substrate. To demonstrate the monolithic approach to microwave power amplification, a single-stage and two-stage push-pull amplifier were designed and fabricated. The two-stage design employs four transistors, a pair of 600 micron gate width devices for the first stage and a pair of 1.2 mm gate width devices for the second stage, monolithically integrated on a 2 mm x 2 mm GaAs chip. The single stage monolithic push-pull amplifier is just 1/2 of the two-stage chip. To provide the necessary 180 deg out of phase signals for the push-pull devices, 180 deg hybrid rings fabricated on alumina substrates are used. The single stage push-pull amplifier exhibits a small signal gain of 8 dB at 9.5 GHz with a 10% 1 dB fractional bandwidth. This amplifier yields 760 mW with 4.7 dB gain, also at 9.5 GHz with 21% power-added efficiency. Author (GRA)

N79-22377# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ANALYSIS OF MODERN DIGITAL MODULATION TECHNIQUES M.S. Thesis

Joseph L. Craddock 15 Dec. 1978 100 p refs

(AF Proj. 2277)

(AD-A064363; AFIT/GE/EE/78-23) Avail: NTIS HC A05/MF A01 CSCL 09/5

Offset Quadriphase Shift Keyed (OQPSK) modulation, Minimum Shift Keyed (MSK) modulation and Sinusoidal Frequency Shift Keyed (SFSK) modulation are analyzed and compared within this report. First, OQPSK, MSK and SFSK are examined both graphically and mathematically, and compared to the fundamental modulation techniques of FSK, PSK and QPSK. Second, a common mathematical framework unifying the three modulation techniques is developed. Third, the theoretical spectral properties of each are calculated. The spectral properties include the autocorrelation function, power spectral density, spectral occupancy, spectral shape and roll off characteristics. Next, the practical spectral properties of the three modulation techniques are developed using a realistic bandlimited, nonlinear channel. Finally, simulated and measured performance of OQPSK and MSK are given and compared using probability of error as the figure of merit. Author (GRA)

N79-22378# Mission Research Corp., La Jolla, Calif.

HARDNESS ASSURANCE FOR LONG-TERM IONIZING RADIATION EFFECTS ON BIPOLAR STRUCTURES Final Report, 1 Apr. 1977 - 1 Mar. 1978

Arthur R. Hart, John B. Smyth, Jr., James P. Raymond, and Victor A. J. Vanlint Mar. 1978 159 p refs

(Contract DNA001-76-C-0201)

(AD-A064136; AD-E300417; MRC/SD-R-23; DNA-4574F) Avail: NTIS HC A08/MF A01 CSCL 09/1

This work assessed the theoretical understanding of long-term ionization effects in semiconductor bipolar devices in support of developing hardness assurance techniques. The principal effort was directed at investigating transistor gain degradation mechanisms by use of models relating semiconductor physical and electrical parameters to surface properties. Ionizing radiation effects on surface properties were used to identify critical physical parameters for use in hardness assurance procedures. Model implications and predictions were then compared with existing data to evaluate accuracy and usefulness. This investigation demonstrated that current theories regarding the surface of bipolar transistors appear to describe the major parameter dependencies if ionizing radiation effects are not considered. It is when radiation effects are incorporated into these theories (models) that fundamental questions arise as to their completeness or validity. Specific questions were found when the surface models originally defined by Reddi and Grove were used to predict the experimental radiation data observed by Sivo. Author (GRA)

N79-22379# Rome Air Development Center, Griffiss AFB, N.Y.

MAGNETOSTATIC WAVE TRANSDUCERS WITH VARIABLE COUPLING

I. J. Weinberg and James C. Sethares Sep. 1978 43 p refs

(AD-A063880; RADC-TR-78-205) Avail: NTIS HC A03/MF A01 CSCL 20/3

Transducer theory for magnetostatic waves in saturated ferrites is extended to include variable coupling. A gap is introduced between transducer and ferrite to adjust the coupling between electromagnetic driving structure and magnetostatic waves. Expressions are developed for the radiation resistance of normal modes of a truncated infinite array and for independent transducer conducting strips of a finite array, as a function of liftoff, for grating and meander transducers. This technology has application in microwave signal processing systems. Author (GRA)

N79-22380# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.

SOLID STATE CLIPPER DIODES FOR HIGH POWER MODULATORS

Stephen Levy and John E. Creedon Nov. 1978 10 p refs

(DA Proj. 1L1-6270-AH-94)

(AD-A064268; DELET-TR-78-25) Avail: NTIS HC A02/MF A01 CSCL 09/1

End-of-line solid state clipper diodes are essential to high power pulse modulators. These diodes are chosen to reduce the potentially damaging inverse network and switch voltages which occur when the load is less than the network impedance; especially when non-constant loads are encountered. The choice of the clipper diode stacks for a megawatt (MW) average power pulser resulted from a study of commercially available units. Destructive tests of available units gave a figure of merit of 300:1 for the maximum single shot 10 microsecond current pulse to diode rated average current. A 150 ampere (A) average current diode was chosen for the 20,000. A worst case expected in the MW pulser gave a current safety factory of better than 2:1. For the 40 kilovolt (kV) pulser operation at a 1.5:1 voltage safety factor required 60 of the 1.0 kV diodes in series. A snubber capacitor and resistor across each diode provided equal voltage division and transient turn-on protection. Transient response of the snubber protected diode stacks was modeled at low powers and later confirmed in actual MW pulser operation. Author (GRA)

N79-22381# Defence Research Establishment, Ottawa. (Ontario).

AN INTERFACE FOR BAK PX219.2 SIMULATORS

Francois Gauthier and John Moffat Sep. 1978 49 p refs In FRENCH; ENGLISH summary

(AD-A064358; CRDO-NT-78-13) Avail: NTIS HC A03/MF A01 CSCL 09/5

This note explains the operation of an interface connecting two BAK PX219.2 radar simulators to a digital computer. The simulators are able to be controlled, either manually by means of the selector switches on the indicator panel, or remotely by a computer capable of transmitting a 16 bit parallel word; a PDP-11 computer has been used for that purpose. The interface uses a Binary/BCD convertor because the simulators have been designed in such a way as to only interpret BCD words. It also

includes different decoder circuits so that the command words may be interpreted in the correct form and that the data words may be routed to the correct register. Two circuits allow the interruption of the program presently executing in the computer if the simulator being addressed is in manual control or if the target pulse reaches the end of the cycle. Author (GRA)

N79-22382# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon System Lab.
MODELING THE EFFECTS OF LIGHTNING ON ELECTRICAL EQUIPMENT Final Report
Daniel Waxler Nov. 1978 55 p refs
(AD-A064591; AD-E400253; ARLCD-TR-78029) Avail: NTIS HC A04/MF A01 CSCL 04/1

A model is developed for computing the safety and reliability of electrical equipment in a lightning environment. The model specifies the parameters of lightning that are pertinent in causing damage to equipment. The report indicates how the model is to be used for testing equipment to determine failure levels. Using these failure levels, it also shows how to compute the actual safety and reliability to be expected in field use, where lightning is a threat. Author (GRA)

N79-22383# Texas Instruments, Inc., Dallas.
IC FABRICATION USING ELECTRON-BEAM TECHNOLOGY
Gilbert L. Varnell, Shang-Yi Chiang, and Jack Reynolds Jan. 1979 35 p
(Contract DAAB07-76-C-8105)
(AD-A064770; TI-03-78-51; DELET-TR-76-8105-8) Avail: NTIS HC A03/MF A01 CSCL 09/2

All of the required environmental and electrical tests of the first article 256-bit Bipolar RAM devices (50) were completed this quarter. These units passed all of the electrical measurements at 0 C, 25 C, and 70 C. However, the maximum operating speed of the units was about 20% slower than desired due to the electron resist being inadvertently removed during the contact oxide etch step. Fabrication of the pilot production units has begun and these units should pass all specifications including operating speed. Author (GRA)

N79-22384# General Electric Co., Schenectady, N. Y.
STUDY OF NOISE IN CID ARRAY SYSTEMS Final Report, 4 Feb. 1977 - 7 Oct. 1978
G. J. Michon, H. K. Burke, T. L. Vogelsong, and K. Wang Nov. 1978 103 p refs
(Contract N00173-77-C-0054)
(AD-A063846; SRD-78-159) Avail: NTIS HC A06/MF A01 CSCL 09/5

A detailed description of CID image sensing and the various readout techniques is given. The results of theoretical and experimental studies of temporal and fixed pattern noise that affects CID imager performance are presented. The effects of feedback on amplifier noise charge are derived. A short study on the low frequency noise of buried channel MOSFETs was also performed. The use of multiple non-destructive readout operations and off-chip signal summation was used to demonstrate more than a factor of 10 improvement in signal-to-noise ratio. No intrinsic limitation on the dynamic range improvement that can be obtained with this technique was identified. External limitations such as the time available for readout have prevailed to date. Standard CID imager noise levels were evaluated. The dynamic range measured varied between 500-to-1 for the TV compatible Pre-injection readout technique to over 30,000-to-1 for a cooled Row Readout array operating at low video rates. Uncorrected signal-to-RMS fixed pattern noise ranged from 30-to-1 for Row Readout 1000-to-1 for Sequential Injection readout. Fixed pattern noise was suppressed to below 1 part in 30,000 with off-chip cancellation circuitry. Author (GRA)

N79-22385# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
MULTIMODED WAVEGUIDE COMPONENTS FOR MILLIMETER WAVE INTEGRATED CIRCUITS Interim Technical Report
S. Bhooshan Sep. 1978 42 p refs
(Grant DAAG29-77-G-0111)
(AD-A063920; UIEM-78-10; UILU-ENG-78-2552; ARO-14686.2-EL) Avail: NTIS HC A03/MF A01 CSCL 09/5

Dielectric guides with convenient dimensions have been known to carry several modes in the 60-90 GHz range. In this report, the possibility of using the multimoded inverted strip guide (ISG) for the construction of passive devices has been investigated for millimeter-wave integrated circuits. A simple approach has been used to analyze the ISG, in that it was assumed to be single moded. With proper excitation this appears to be true. Two types of ISG's have been examined: the quartz-teflon and teflon-teflon guides. With each type of guide two passive components were tested: the distributed line directional coupler and the single pole ring resonator. Results have been presented which agree quite well with the theory. Analysis of the ISG and passive components has been included. Author (GRA)

N79-22386# Naval Avionics Center, Indianapolis, Ind.
IMPROVED STANDARD ELECTRONIC MODULES, THERMAL AND MECHANICAL ANALYSES AND DESIGN Summary Report, Fiscal Year 1977
William G. Taw 1 Sep. 1978 173 p Prepared in part by the Naval Weapons Support Center, Crane, Ind.
(AD-A064128; NAC-TR-2217) Avail: NTIS HC A08/MF A01 CSCL 09/5

This report covers the design, development, and thermal modeling and testing of a new module family, the Improved Standard Electronic Modules (ISEM), which is compatible with the existing SEM Program modules. Naval Ocean Systems Center (NOSC) directed Naval Avionics Center (NAC), in conjunction with Naval Weapons Support Center (NWSC), to develop, test, and fabricate the Improved SEM. Author (GRA)

N79-22387# RCA Labs., Princeton, N. J.
CCD LONG-TIME DELAY LINE Interim Report, 15 May 1977 - 15 Feb. 1978
W. F. Kosonocky and D. J. Sauer Nov. 1978 50 p refs
(Contract F19628-77-C-0176)
(AD-A063800; PRRL-78-CR-9; RADC-TR-78-236; IR-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

A low-loss mode for operating CCDs is described that should lead to a decrease of the transfer losses in long CCD structures by more than two orders of magnitude. The analysis indicates that a buried-channel CCD operating in the low-loss mode should have an effective transfer loss of less than 10 to the -7th power per transfer. This report also describes the design of a low-loss CCD test chip containing 256- and 1024-stage, closed-loop CCDs. Operating as low-loss CCDs, these devices can store and recirculate 128 and 512 signal samples, respectively. The closed-loop CCD structures include a provision for adding input signal to the signal already present in the loop. In addition to the low-loss signal regeneration stages (one in the smaller loop and two in the larger loop), each closed-loop CCD also includes two floating-gate outputs for nondestructive output sensing, a floating-diffusion output for a destructive readout, and a dark-current subtraction stage. Also described in the report is the design of a programmable tester for operating the closed-loop CCDs on the low-loss CCD test chip. Author (GRA)

N79-22388# TRW Defense and Space Systems Group, Redondo Beach, Calif. Microelectronics Center.
HIGH FREQUENCY ANALOG LSI DEVELOPMENT Interim Report, 1 Sep. 1977 - 1 Sep. 1978
John Choma, Jr. 1 Oct. 1978 250 p refs
(Contract N00123-77-C-1045)
(AD-A064100; TRW-30491-6014-RU-00) Avail: NTIS HC A11/MF A01 CSCL 09/5

This report documents all analysis and design efforts undertaken in the first year of a three-year program aimed toward utilizing OAT fabrication technology to develop building block circuits appropriate to the satisfaction of system requirements for communication networks operating through L-band. Basic circuit techniques for LSI are discussed in depth, as are the design and fabrication of universal RF building blocks. The results of a GPS receiver system/module interface study are presented. Finally, the fabricated realization of a GPS test chip is developed and completely defined. Author (GRA)

N79-22389# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.

PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES. VOLUME 1: PROCESS SPECIFICATION Final Report, 1 Jul. 1975 - 31 Dec. 1978
A. W. Dozier Dec. 1978 302 p
(Contract DAAB07-75-C-0044)
(AD-A064197; FR-79-12-40-Vol-1; DELET-TR-75-0044-F-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 09/5

The object of the program was the establishment of a production capability for surface acoustic wave devices of varied design and material for the purpose of meeting estimated military needs for a period of two years after the completion of the contract, and to establish a base and plans which may be used to meet expanded requirements. The primary requirement was the pilot line production of devices that are reliable, reproducible, and low cost. The first phase of this program required the design, fabrication and testing of a total of 60 prototype bandpass, tapped delay line and pulse compression SAW filters on both lithium niobate and ST-quartz. The First engineering Phase (Phase I) electrical testing demonstrated that the device designs generally met the specifications imposed by the program. Deviations from specification, which required additional tests to optimize the levels of padding and/or shunt resistance and capacitance, were resolved during the Second Engineering Phase(Phase II) for the PC-Q, PC-LN and TDL-200. Deviations from the insertion loss specification occurred with the BP-LN and TDL-100 designs. In the former case, a redesign excluding the program-specified multi-strip coupler, was theoretically evaluated. In the latter case, as pointed out in the Hughes proposal, a theoretical analysis precluded the possibility of a specification accommodation. GRA

N79-22390# Northrop Corp., Des Plaines, Ill. Defense Systems Div.
I/J BAND LOW-COST CROSSED-FIELD AMPLIFIER Interim Technical Report, 28 Sep. 1977 - 8 May 1978
Robert R. Moats Dec. 1978 29 p
(Contract DAAB07-77-C-2642)
(AD-A063928; DELET-TR-77-2642-2; Rept-094-008686) Avail: NTIS HC A03/MF A01 CSCL 09/1

This program is directed toward development of an I/J band, linear format, injected-beam crossed-field amplifier (IBCFA) for electronic warfare. The IBCFA should be capable of power output of 1000 W peak, 200 W average, between 8.5 and 17 GHz with 20 dB gain. A laser-cut shaped-substrate meander line is used. Performance in an E/F band IBCFA is evaluated, for which the objective performance in the 2-4 GHz band is 3.0 kW peak power output, 1.0 kW average power output, also with 20 dB gain. In addition, a gun for I/J band is to be designed and evaluated. For E/F band, a cold-test model was built using the same technology as contemplated for operating tubes. Values of delay ratio, coupling impedance, and attenuation were substantially as expected. An E/F-band operating CFA using the shaped-substrate meander line, and other parts common with a standard E/F-band CFA design, was built and tested. Performance was comparable with a typical CFA of standard design, slightly lower in efficiency at mid band and approximately the same over the remaining part of the 2-4 GHz band. An I/J-band cold-test model was built, and measurements of delay ratio, coupling impedance, and attenuation were made. Results showed that a reduction of pitch and a thinner substrate are necessary for an efficient I/J band tube. GRA

N79-22391# Purdue Univ., Lafayette, Ind. Turner Lab. for Electroceramics.
THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Quarterly Report, 1 Aug. - 31 Oct. 1978
R. W. Vest 30 Nov. 1978 42 p refs
(Contract N00019-78-C-0236)
(AD-A063782; QR-3) Avail: NTIS HC A03/MF A01 CSCL 09/1

The sheet resistance, temperature dependence of the resistance, and the current noise were measured for thick film resistors as a function of the amount of alumina substrate dissolved in the resistor glass for resistor firing times from 4 to 22 minutes at 800 C. Large variations in these three properties were observed, and the changes were qualitatively correlated with changes in viscosity of the glass. The microstructure development and charge transport model used to correlate the results involves changing proportions of sintered and non-sintered contacts in the RuO2 networks within the body of the resistors. The solubility of RuO2 in the resistor glass was determined as a function of temperature and amount of substrate dissolved in the glass, and the kinetics of substrate dissolution were measured under varying processing conditions. Preliminary results on MIM devices fabricated with resistor glasses are presented. Author (GRA)

N79-22392# Radio Corp. of America, Lancaster, Pa. SSD-Electro-Optics and Devices.
MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) MEASURE FOR FABRICATION OF SILICON TRANSCALENT THYRISTOR Quarterly Progress Report, 1 Jul. - 30 Sep. 1978
B. B. Adams, S. W. Kessler, R. E. Reed, and D. R. Trout Jul. 1978 48 p
(Contract DAAB07-76-C-8120)
(AD-A064127; QPR-8) Avail: NTIS HC A03/MF A01 CSCL 09/1

This Eighth and Final Quarterly Report describes the conclusion of the MM and TE program for the Transcalent(Heat-Pipe cooled) thyristors. Production engineering measures for the device have been concluded. Test results on the 40 pilot production samples are listed. The present status includes the successful completion of the pilot production rate demonstration in accordance with the Preliminary Pilot Run Report as well as the completion of the fabrication of all of the pilot production devices and their shipment to the government. Plans for the next period include the completion of the documentation requirements which include the final monthly reports, this final quarterly report, the final technical report and the general report on Step 2. Author (GRA)

N79-22393# Westinghouse Research and Development Center, Pittsburgh, Pa.
THEORY AND DESIGN OF ELECTRICAL ROTATING MACHINERY Annual Report, 1 Nov. 1977 - 31 Oct. 1978
W. J. Carr, Jr. Dec. 1978 25 p refs
(Contract N00014-72-C-0432)
(AD-A064303; AR-6) Avail: NTIS HC A02/MF A01 CSCL 09/3

The objective of this program is to contribute toward new and improved rotating machines for Naval applications, with emphasis on superconducting machinery. Work has been performed on the theory of ac losses in multifilament superconductors and experiments were made to check the theory. A list of publications and abstracts of scientific papers published under the contract is given. Author (GRA)

N79-22394# Xonics, Inc., Santa Monica, Calif.
THEORY OF THE INTERACTION OF INFRARED RADIATION WITH SOLIDS Final Technical Report, 1 Apr. - 30 Nov. 1978
M. Sparks 30 Nov. 1978 20 p
(AD-A064751; AFOSR-79-0035TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

A transport equation for electron-avalanche breakdown, including large- and small-quantum effects, was developed, checked by two derivations, compared with previous results, solved by three methods (numerical solution of partial-differential equation, casting into eigenvalue differential equation form, approximate intuitive solution), applied to simple models and to cases of practical interest, and compared with gas-breakdown results. Large-quantum processes, including interband transitions and various processes in which photons are absorbed simultaneously with processes which allow momentum conservation will be considered. Intraband processes (valence band to final conduction band plus intraconduction band, for example) as well as the usual interband process in two-photon absorption-coefficient calculations gave good agreement (factor of 0.5 to 4) with Harvard experimental results without adjusting parameter values. Calculations showed that including a linear temperature dependence of the optical absorptance of metallic or dielectric reflectors gave much higher temperatures and damage susceptibilities in general than for the case of temperature-independent absorptance and gave thermal runaway in several interesting cases. GRA

N79-22395# Ohio State Univ., Columbus. Electroscience Lab.
JOINT SERVICE ELECTRONICS PROGRAM Annual Report, Sep. 1977 - Oct. 1978
Dec. 1978 87 p refs
(Contract N00014-78-C-0049)
(AD-A064791; ESL-710816-1) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report presents the first annual review of research at Ohio State sponsored by the Joint Services Electronics Program (JSEP). The research is in the area of electromagnetics and the specific topics are: (1) Diffraction Studies; (2) Hybrid Techniques; (3) Surface Cell Model; (4) Electrically Small Antenna Studies; (5) Time Domain Studies; and (6) Adaptive Array Studies.
Author (GRA)

N79-22396# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.
LOW INDUCTANCE, LOW IMPEDANCE MEGAWATT AVERAGE POWER LOAD
William Wright, Jr. Nov. 1978 9 p refs
(AD-A064824; DELET-TR-78-27) Avail: NTIS HC A02/MF A01 CSCL 14/2

A compact, low inductance, one-half ohm, one megawatt average power resistive load has been developed to facilitate testing of the MAPS-40 Thyratron. The flowing liquid electrolyte system uses the large thermal mass of a storage tank of electrolyte to store the energy which is dissipated through a heat exchanger after the high power run. The electrolyte starting temperature, flow rate, and allowable temperature rise determine the maximum average power into the load; the external and internal spacings and flow uniformity determine the maximum peak power; and flow rate and storage volume determine maximum running time. The load assembly consists of two parallel glass pipes 10.2 in diameter and 15.25 cm long. The active volume in each pipe is 6.35 cm long and is contained between electrodes 8.9 cm in diameter. The two sections of the load are electrically in parallel and flowing in series, putting both flow connections at ground potential. The major problem was getting the internal flow pattern uniform to eliminate local boiling and arcing across the bubbles while keeping the pressure drop low and flow high. The calculated inductance of the load assembly is 11 nanohenry(nH), and the structure lends itself to coaxial connections which reduce the overall inductance still further. Material compatibility with the electrolyte will be discussed.
Author (GRA)

N79-22397# RCA Labs., Princeton, N. J.
EXTENDED RANGE MIS C(V) MEASUREMENT: A TECHNIQUE FOR MONITORING SEMICONDUCTOR DEVICE PROCESSING Final Report, 24 Apr. 1975 - 30 Sep. 1976
A. M. Goodman Jan. 1979 19 p refs
(Contract NBS-5-35912; ARPA Order 2397)
(PB-291011/5; NBS-GCR-78-155) Avail: NTIS HC A02/MF A01 CSCL 09A

Equipment was developed which allows the straightforward implementation of extended-range MIS C(V) and G(V) measurements for a variety of applications at applied-bias voltage magnitudes as large as 25 kV. Corrections and additions to previously published documents to aid in the construction and operation of the apparatus was given.
GRA

N79-22156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A GENERAL LOGIC STRUCTURE FOR CUSTOM LSI
M. W. Sievers *In its* The Deep Space Network 15 Apr. 1979 p 97-105 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N79-22166*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
X-3060 KLYSTRON DESIGN IMPROVEMENT PROGRAM STATUS
A. Goldfinger and M. A. Gregg *In its* The Deep Space Network 15 Apr. 1979 pp 106-205 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09A

N79-22169*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-X 34-METER CONVERSION RECEIVER AND MICROWAVE PERFORMANCE
H. R. Buchanan *In its* The Deep Space Network 15 Apr. 1979 p 219-225 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09A

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N79-22398 Kansas State Univ., Manhattan..
SIMILARITY SOLUTIONS FOR REACTIVE FLOW Ph.D. Thesis
R. Jose De Jesus Perez 1978 88 p
Avail: Univ. Microfilms Order No. 7906795

The similarity method is used to solve a one-dimensional, time-dependent hydrodynamics process with a chemical reaction. The chemical reaction is induced by a propagating shock wave which is introduced into the medium by a piston at time $t = 0$. In the first chapter we review the mathematical techniques concerning one-parameter local Lie groups and their application to reduce the number of independent variables in a system of partial differential equations. The reactive flow problem is stated, and known results about this problem are briefly mentioned. The group under which the equations of motion, chemical reaction rate equation, and boundary conditions are invariant. It is found that, in order that this invariant group be nontrivial, the reaction rate must be of a special form.
Dissert. Abstr.

N79-22399 Northwestern Univ., Evanston, Ill.
THE DRYOUT OF A THIN HEATED LIQUID FILM Ph.D. Thesis
Jihchin Chung 1978 147 p
Avail: Univ. Microfilms Order No. 7907857

The breakdown of a thin liquid film in the annular two-phase cocurrent downward flow under heating was studied theoretically and experimentally. Three different models were developed to predict the breakdown condition. Comparison of the experimental data with the small perturbation theory shows that an empirical value of amplification factor of about 6, corresponding to a contact angle of approximately 80 deg is required for film breakup. Based on this value the small perturbation theory was found to agree with data satisfactorily. For the rivulet model and dry-patch model, the data can also be fitted by choosing a large contact angle. An explanation was given to account for the effect of heating, as well as the surface roughness and contamination.
Dissert. Abstr.

N79-22400 Michigan Univ., Ann Arbor.
BLAST WAVE INITIATED HETEROGENEOUS AND GASEOUS DETONATION WAVES Ph.D. Thesis
Zdravko Milan Gabrijel 1978 314 p
Avail: Univ. Microfilms Order No. 7907077

The blast wave initiation of cylindrical detonations in heterogeneous and homogeneous mixtures was studied. A sectored shock tube was used which corresponds to a pie shaped sector of a cylindrically shaped combustible cloud. The mixture to be studied was introduced into the chamber and a cylindrical blast wave was generated by firing a blasting cap and condensed explosive at the apex of the chamber. The wave front position as a function of time, and hence wave velocity, was sensed by a set of 17 pressure switches mounted on the centerline on one wall of the chamber. In some cases, limited high frequency response pressure variations were obtained. Initially, experiments were conducted to determine how close the blast waves generated corresponded to idealized cylindrical behavior. Comparison of the results with theory showed that significant differences existed. Brief analyses revealed that nonideal blast wave

development and confinement effects were probably responsible for the observed discrepancies. Dissert. Abstr.

N79-22401 Pennsylvania State Univ., University Park.
NUMERICAL SIMULATION OF THE COMPACTION-SUBSIDENCE PHENOMENA IN A RESERVOIR FOR TWO-PHASE NONISOTHERMAL FLOW Ph.D. Thesis
Turgay Ertekin 1978 257 p
Avail: Univ. Microfilms Order No. 7909064

An integrated mathematical model which simulates the behavior of a simultaneously fluid-producing, compacting reservoir and the ground above it is developed. The first part of the mathematical model studies the performance of a closed two-dimensional reservoir which is subjected to hot water injection. Temperature, pressure, and saturation distributions obtained from the first part are used as input to the second part of the mathematical model wherein subsidence-compaction phenomena for a reservoir which is embedded in a semi-infinite poroelastic medium is investigated. The utility of the mathematical model is demonstrated by solving the problem under a variety of field conditions. Results show that hot waterflooding can recover significantly more oil than cold waterflooding. The increase in recovery is directly proportional to the injection rate, injection temperature, and reservoir thickness, and inversely proportional to the thermal conductivity of the overburden and the underburden formations. Dissert. Abstr.

N79-22402 Ohio State Univ., Columbus.
AN EXPERIMENTAL STUDY OF TWO DIMENSIONAL IMPINGEMENT COOLING Ph.D. Thesis
Nuri Kayansayan 1978 160 p
Avail: Univ. Microfilms Order No. 7908161

The experimental work studied the heat transfer characteristics of two-dimensional air jets in series, impinging normally on a flat surface. These physical arrangements were such that the air jets were issued from the upper wall of a two-dimensional flat channel with the heated lower wall serving as the impingement surface. The two ends of the flat channel were open, and the five air jets of equal strength were evenly spaced and symmetrically located on the upper wall such that the resulting configuration was symmetrical. The flow division was, therefore, that through each open end of the two-dimensional channel the air flow was one-half of the total air flow from the five air jets. The controlling parameters in non-dimensional representation study were: (1) ratio of channel height to jet width, (2) ratio of jet spacing to jet width, and (3) the jet Reynolds number formed by the air jet velocity and jet width. The height ratio was varied from one to three, and the spacing ratio was in the range of two to four. The span of the Reynolds number variation was from 100 to 15000. Dissert. Abstr.

N79-22403 Northwestern Univ., Evanston, Ill.
LIQUID-LIQUID CONTACT IN VAPOR EXPLOSION Ph.D. Thesis
Aryeh Segev 1978 341 p
Avail: Univ. Microfilms Order No. 7907932

Cold liquids (Freon-11, Freon-22, water, or butanol) were impacted upon various hot materials (mineral oil, silicone oil, water, mercury, molten Wood's metal or molten salt mixture). Large pressures were obtained for systems of water-Wood's metal, butanol-Wood's metal and water-salt. With water-Wood's metal three separate regions were observed. Experiments with water and molten salt at 410 C and 600 C (eutectic mixture of LiCl-KCl) resulted in low yield thermal interactions. Hydrodynamic effects may be very significant in any shock tube analyses, especially when multiple interactions are observed.
Dissert. Abstr.

N79-22404# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
VKI SHORT COURSE ON RAREFIED GAS DYNAMICS
Mar. 1969 313 p refs Lecture held at Rhode-Saint-Genese, Belgium, 3-7 Mar. 1969
(VKI-Lecture-Series-13) Avail: NTIS HC A14/MF A01

The application of the kinetic theory to the problems in gas dynamics was investigated. The written text for the course and the contributions made by the lecturers are presented. For individual titles, see N79-22405 through N79-22412.

N79-22405# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
CLASSICAL STATISTICAL MECHANICS
J. J. Smolderen *In its* VKI Short Course on Rarefied Gas Dyn. Mar. 1969 40 p (For primary document see N79-22404 13-34)
Avail: NTIS HC A14/MF A01

Statistical mechanics are presented to explain the properties of matter by analyzing elementary molecular or atomic processes. Molecular motions are described and statistics are formulated. The probability of molecules of a system in equilibrium, Boltzmann equilibrium distribution, statistical thermodynamics, and Maxwell velocity distribution are discussed. S.E.S.

N79-22406# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ELEMENTARY KINETIC THEORY OF GASES
J. J. Smolderen *In its* VKI Short Course on Rarefied Gas Dyn. Mar. 1969 19 p (For primary document see N79-22404 13-34)
Avail: NTIS HC A14/MF A01

The velocity distribution function, observables of the distribution function, collisions and cross sections, collision frequencies and mean free paths elementary theory of transport phenomena, and fundamentals of free molecule flow are discussed. S.E.S.

N79-22407# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTERACTION OF GASES WITH SOLID BOUNDARIES
J. J. Smolderen *In its* VKI Short Course on Rarefied Gas Dyn. Mar. 1969 31 p refs (For primary document see N79-22404 13-34)
Avail: NTIS HC A14/MF A01

Gas-wall processes are described in surface interaction. Models for wall processes and slip flow effects are developed. S.E.S.

N79-22408# Applicazioni e Ricerche Scientifiche, Milan (Italy).
THE BOLTZMANN EQUATION AND ITS MODELS
Carlo Cercignani *In* Von Karman Inst. for Fluid Dyn. VKI Short Course on Rarefied Gas Dyn. Mar. 1969 refs (For primary document see N79-22404 13-34)
Avail: NTIS HC A14/MF A01

The progress achieved in understanding the transition regime of rarefied gas dynamics by means of the kinetic theory of gases is presented. S.E.S.

N79-22409# Paris Univ. (France). Lab. de Mecanique.
THE BOLTZMANN H THEOREM AND RELATED MATHEMATICAL TOPICS
J. P. Guiraud *In* Von Karman Inst. for Fluid Dyn. VKI Short Course on Rarefied Gas Dyn. Mar. 1969 55 p refs (For primary document see N79-22404 13-34)
Avail: NTIS HC A14/MF A01

The Boltzmann equation and its boundary operators are presented. Initial and boundary conditions are established at a rigid wall and at infinity. S.E.S.

N79-22410# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TECHNIQUES FOR THE APPROXIMATE OR NUMERICAL TREATMENT OF THE BOLTZMANN EQUATION
J. J. Smolderen *In its* VKI Short Course on Rarefied Gas Dyn. Mar. 1969 15 p refs (For primary document see N79-22404 13-34)
Avail: NTIS HC A14/MF A01

Methods based on linearized Boltzmann equation with Maxwellian problems are presented. The Chapman-Enskog approach, integral iterations, and linear Boltmann equation are treated. Moment methods, least squares methods, discrete ordinate techniques, and Monte Carlo methods are described. S.E.S.

N79-22411# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
KINETIC THEORY OF HYPERSONIC SPHERICAL EXPANSION (SOURCE FLOW)
J. J. Smolderen *In its* VKI Short Course on Rarefied Gas Dyn. Mar. 1969 15 p refs (For primary document see N79-22404 13-34)

Avail: NTIS HC A14/MF A01

The problem of free expansion of a gas jet into an extremely rarefied atmosphere or vacuum is presented. Hamel's hypersonic approximation, conservation equations for the hypersonic source flow, moment equations, and solution of the moment equation-translational freezing. S.E.S.

N79-22412# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Low Density Lab.

SHOCK WAVE STRUCTURE

J. F. Wendt *In its* VKI Short Course on Rarefied Gas Dyn. Mar. 1969 15 p refs (For primary document see N79-22404 13-34)

Avail: NTIS HC A14/MF A01

Navier-Stokes shock structure, moment methods, krook equation Mott-Smith plus krook model, and Monte Carlo methods are used in the classical fluid mechanics treatment of shock waves. S.E.S.

N79-22413# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

THERMAL RADIATION IN INDUSTRIAL FLAMES

1971 320 p refs Lecture Ser. held at Rhode-Saint-Genese, Belgium, 6-10 Dec. 1971

(VKI-Lecture-Series-41) Avail: NTIS HC A14/MF A01

The following topics are discussed: (1) radiation from flames in furnaces; (2) calculation of radiative heat transfer in gas filled enclosures; (3) prediction of the radiative behavior of luminous flames; (4) measurement of radiation from industrial flames; (5) recent experimental investigations at Ijmuiden; and (6) scattering as a diagnostic tool. For individual titles, see N79-22414 through N79-22421.

N79-22414# Sheffield Univ. (England).

RADIATION FROM FLAMES IN FURNACES

J. M. Beer *In* Von Karman Inst. for Fluid Dyn. Thermal Radiation in Ind. Flames 1971 32 p refs (For primary document see N79-22413 13-34)

Avail: NTIS HC A14/MF A01

Theoretical and experimental research on the radiative transport from flames in furnaces is reviewed. A flow chart of the procedure of solving a radiative transfer problem is presented. Banded and continuous emission in furnace flames is considered. Emission from particulate clouds is discussed. The experimental information surveyed is presented in two groups: radiometric measurements on industrial size flames, and physical measurements of radiative properties of absorbing emitting scattering media. G.Y.

N79-22415*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INTRODUCTION: THERMAL RADIATION IN INDUSTRIAL FLAMES

R. Siegel *In* Von Karman Inst. for Fluid Dyn. Thermal Radiation in Ind. Flames 1971 72 p refs (For primary document see N79-22413 13-34)

Avail: NTIS HC A14/MF A01 CSCL 20D

The following topics are addressed: (1) emissive characteristics of a blackbody; (2) definition of properties for nonblack surfaces; (3) fundamentals of radiation in absorbing, emitting, and scattering media; (4) radiation in the presence of other modes of energy transfer; and (5) propagation in isotropic medium (the complex refractive index). G.Y.

N79-22416# Sheffield Univ. (England).

THE CALCULATION OF RADIATIVE HEAT TRANSFER IN GAS FILLED ENCLOSURES

R. G. Siddall *In* Von Karman Inst. for Fluid Dyn. Thermal Radiation in Ind. Flames 1971 66 p refs (For primary document see N79-22413 13-34)

Avail: NTIS HC A14/MF A01

Two major types of method for producing detailed predictions on temperature and heat flux desnity in enclosures; the zone method, and various flux methods are presented. G.Y.

N79-22417# International Flame Research Foundation, Ijmuiden (Netherlands).

PREDICTION OF THE RADIATIVE BEHAVIOUR OF LUMINOUS FLAMES

T. M. Lowes *In* Von Karman Inst. for Fluid Dyn. Thermal Radiation in Ind. Flames 1971 11 p refs (For primary document see N79-22413 13-34)

Avail: NTIS HC A14/MF A01

The mathematical modelling of heat transfer in a combustion chamber requires basically four individual models, namely of fluid dynamics, kinetics, emission/attenuation coefficients and radiant exchange. The only grey area in the radiative heat transfer aspects of furnace modelling is emission/attenuation coefficients of luminous flames. Recent trials measured these in detail for oil, gas and pulverized fuel flames. A model is presented which predicts the values obtained, within the limits of available data on particle properties. G.Y.

N79-22418# International Flame Research Foundation, Ijmuiden (Netherlands).

THE MEASUREMENT OF RADIATION FROM INDUSTRIAL FLAMES

M. P. Heap *In* Von Karman Inst. for Fluid Dyn. Thermal Radiation in Ind. Flames 1971 14 p refs (For primary document see N79-22413 13-34)

Avail: NTIS HC A14/MF A01

Two instruments are used regularly during furnace trials to provide basic information on the sources and sinks of thermal radiation in flames, the narrow angle radiometer and the suction radiometer. An ellipsoidal probe is also used to measure the total radiative flux arriving from a hemispherical space at a surface element. The construction and method of operation of these probes are described and examples of their use in recent trials are given. G.Y.

N79-22419# International Flame Research Foundation, Ijmuiden (Netherlands).

RECENT EXPERIMENTAL INVESTIGATIONS AT IJMUIDEN

T. M. Lowes *In* Von Karman Inst. for Fluid Dyn. Thermal Radiation in Ind. Flames 1971 24 p refs (For primary document see N79-22413 13-34)

Avail: NTIS HC A14/MF A01

Because of the expense of large scale work and the limitations in the interpretation of isothermal models there is a strong incentive to develop mathematical models to predict furnace performance. Some paper on mathematical modeling techniques are rather complex and it is difficult for the engineer to fully appreciate their scope and limitations without a detailed study. Information is supplied aimed at detailing and critically reviewing the most useful models available for the prediction of heat flux, and at the same time indicating the approach to their development and testing. G.Y.

N79-22420# Imperial Coll. of Science and Technology, London (England).

APPROXIMATIONS IN RADIATIVE SCATTERING

A. R. Jones *In* Von Karman Inst. for Fluid Dyn. Thermal Radiation in Ind. Flames 1971 15 p refs (For primary document see N79-22413 13-34)

Avail: NTIS HC A14/MF A01

The radiative properties of a cloud of particles are governed by electromagnetic scattering. A rigorous theory of scattering in particle clouds must take into account multiple scattering. In furnace flames two basic types of particles may be distinguished from a scattering point of view: powdered coal or liquid oil droplets (very large particles); and soot (very small particles). The scattering by single particles and emission by clouds of particles (large and small) are discussed. G.Y.

N79-22421# Imperial Coll. of Science and Technology, London (England).

EM SCATTERING AS A DIAGNOSTIC TOOL

A. R. Jones *In* Von Karman Inst. for Fluid Dyn. Thermal Radiation in Ind. Flames 1971 14 p refs (For primary document see N79-22413 13-34)

Avail: NTIS HC A14/MF A01

Several methods of analyzing properties of a cloud of particles are briefly discussed. Some of the methods and examples are illustrated by discussing some measurements on particles (TiO2) in flames. Measurements on soot in flames and special

uses of lasers for scattering measurement are also discussed. G.Y.

N79-22422# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
LAMINAR AND TURBULENT SEPARATION INCLUDING THREE-DIMENSIONAL EFFECTS
1974 231 p refs Lecture Series held at Rhode-Saint-Genese, Belgium, 28 Jan. - 1 Feb. 1974
(VKI-Lecture-Series-62) Avail: NTIS HC A11/MF A01

A theoretical model to study viscous interactions for supersonic-hypersonic flow is presented. Correlations of the important characteristics of shock wave interactions and the fluctuating properties are discussed. The pressure induced type of separation in three dimensions and its difference with the envelope concept are reported. For individual titles, see N79-22423 through N79-22425.

N79-22423# Aeronautical Research Labs., Wright-Patterson AFB, Ohio.
THEORETICAL DEVELOPMENTS IN SUPERSONIC SEPARATED FLOWS
Wilbur L. Hankey, Jr. *In* Von Karman Inst. for Fluid Dyn. Laminar and Turbulent Separation Including 3-Dimensional Effects 1974 97 p refs (For primary document see N79-22422 13-34)
Avail: NTIS HC A11/MF A01

The details of obtaining solutions for supersonic hypersonic interacting flows are presented. The classical results of boundary layer flows relevant to separation are discussed. A theoretical model for viscous interactions depicting equations for boundary layers, inviscid flows, and coupling are described. This model achieved convergence in ten iterations, thus enabling the engineer to automatically solve practical problems. Special topics on integral methods advanced turbulence models, and Navier-Stokes solutions are reported. M.M.M.

N79-22424# Calspan Corp., Buffalo, N. Y.
EXPERIMENTAL STUDIES OF SHOCK WAVE-BOUNDARY LAYER INTERACTION
M. S. Holden *In* Von Karman Inst. for Fluid Dyn. Laminar and Turbulent Separation Including 3-Dimensional Effects 1974 90 p refs (For primary document see N79-22422 13-34)
Avail: NTIS HC A11/MF A01

The characteristics of laminar and turbulent separated flows are examined with the viewpoint of obtaining evidence which will assist in formulating or evaluating simple models of these flows, and providing information of direct use in design or which can be compared eventually with full solutions of the Navier-Stokes equations. In discussing turbulent separation, the basic mechanics of flow separation and reattachment in regions of shock wave-boundary layer interaction, and the complex effects of Reynolds number and Mach number on the occurrence and properties of these regions were examined. Correlations of the important characteristics are presented and measurements of the fluctuating properties of these flows are examined. Author

N79-22425# Ecole Nationale Superieure d'Electricite et de Mechanique, Nancy (France).
THREE-DIMENSIONAL SEPARATION
Ernest Eichelbrenner *In* Von Karman Inst. for Fluid Dyn. Laminar and Turbulent Separation Including 3-Dimensional Effects 1974 36 p (For primary document see N79-22422 13-34)
Avail: NTIS HC A11/MF A01

Fundamental difference between 2- and 3-dimensional separation is discussed. Maskell's scheme and its domain of validity, in particular with respect to the envelope concept is examined. The pressure-induced type of separation in 3 dimensions and its difference with the envelope concept are presented. Author

N79-22426*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TITANIUM-ALLOY, METALLIC-FLUID HEAT PIPES FOR SPACE SERVICE
James F. Morris Mar. 1979 15 p refs
(NASA-TM-79132; E-9974) Avail: NTIS HC A02/MF A01 CSCL 20D

Reactivities of titanium limit its long-term terrestrial use for unprotected heat-pipe envelopes to about 870 K (1100 F). But this external thermochemical limitation disappears when considerations shift to space applications. In such hard-vacuum utilization much higher operating temperatures are possible. Primary restrictions in space environment result from vaporization, thermal creep, and internal compatibilities. Unfortunately, a respected head-pipe reference indicates that titanium is compatible only with cesium from the alkali-metal working-fluid family. This problem and others are subjects of the present paper which advocates titanium-alloy, metallic-fluid heat pipes for long-lived, weight-effective space service between 500 and 1300 K (440 and 1880 F). Author

N79-22427*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REVIEW AND STATUS OF LIQUID-COOLING TECHNOLOGY FOR GAS TURBINES
G. James VanFossen, Jr. and Francis S. Stepka Washington Apr. 1979 31 p refs
(NASA-TP-1038; E-9517; AVRADCOM-TR-78-21) Avail: NTIS HC A03/MF A01 CSCL 20D

A review was conducted of liquid-cooled turbine technology. Selected liquid-cooled systems and methods are presented along with an assessment of the current technology status and requirements. A comprehensive bibliography is presented. Author

N79-22428*# Stanford Univ., Calif.
FULL-COVERAGE FILM COOLING: 3-DIMENSIONAL MEASUREMENTS OF TURBULENCE STRUCTURE AND PREDICTION OF RECOVERY REGION HYDRODYNAMICS Final Report
S. Yavuzkurt, R. J. Moffat, and W. M. Kays Mar. 1979 188 p refs
(Contract NAS3-14336)
(NASA-CR-3104; SU-HMT-27) Avail: NTIS HC A09/MF A01 CSCL 20D

Hydrodynamic measurements were made with a triaxial hot-wire in the full-coverage region and the recovery region following an array of injection holes inclined downstream, at 30 degrees to the surface. The data were taken under isothermal conditions at ambient temperature and pressure for two blowing ratios: M = 0.9 and M = 0.4. Profiles of the three main velocity components and the six Reynolds stresses were obtained at several spanwise positions at each of the five locations down the test plate. A one-equation model of turbulence (using turbulent kinetic energy with an algebraic mixing length) was used in a two-dimensional computer program to predict the mean velocity and turbulent kinetic energy profiles in the recovery region. A new real-time hotwire scheme was developed to make measurements in the three-dimensional turbulent boundary layer over the full-coverage surface. Author

N79-22429*# Stanford Univ., Calif.
HEAT TRANSFER TO A FULL-COVERAGE, FILM-COOLED SURFACE WITH COMPOUND-ANGLE (30 DEG AND 45 DEG) HOLE INJECTION Final Report
H. K. Kim, R. J. Moffat, and W. M. Kays Feb. 1979 159 p refs
(Contract NAS3-14336)
(NASA-CR-3103; SU-HMT-28) Avail: NTIS HC A08/MF A01 CSCL 20D

An experimental study of heat transfer was conducted on a turbulent boundary layer with full-coverage film cooling through an array of holes inclined at 30 deg to the surface and 45 deg to the flow direction (compound-angle injection). Heat transfer coefficients were measured over a range of injectant flows (M = 0 to M = 1.5) and Reynolds numbers at velocities between 9.8 and 16.8 m/s. Data are presented for injectant temperature equal to the wall temperature and injectant temperature equal to the stream temperature. Compound-angle injection gives better thermal protection than in-line, slant-hole injection, but the beneficial effect is minimal in the first six rows of holes. For a value of M = 0.37 the heat transfer coefficient with compound-angle injection was the same as for the slant-angle injection after six rows, but was only one-half the slant-hole value after 11 rows. The data for compound-angle injection show the same general features as for slant-angle and normal injection. Recovery is rapid after the last row of holes, with the heat

transfer returning to a conventional smooth-plant correlation. The data for M = 0.4 show the lowest values of Stanton number. Pitch-to-diameter ratio of 10 provides less thermal protection than 5, for the same value of M. Author

N79-22430# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

INTERFEROMETRIC TECHNIQUES AND DATA EVALUATION METHODS FOR THE UTIAS 10 cm X 18 cm HYPERVELOCITY SHOCK TUBE

G. Ben-Dor and B. T. Whitten Mar. 1979 60 p refs
(Grant AF-AFOSR-3033-77)
(UTIAS-TN-208; CN-ISSN-0082-5263) Avail: NTIS HC A04/MF A01

The UTIAS 10 cm x 18 Hypervelocity Shock Tube was used to study ionizing shock structures, flat-plate and side-wall boundary layers and nonstationary oblique shock-wave diffractions over compression corners. These phenomena were recorded using a 23-cm dia field of view Mach-Zehnder interferometer equipped with a giant-pulse dual-frequency ruby laser. The experimental technique and instrumentation associated with the various measurements involved in research using the UTIAS 10 cm x 18 cm Hypervelocity Shock Tube are described. The maximum possible absolute and relative errors associated with these measurements are calculated for four different gases (argon, krypton, oxygen and nitrogen) which are usually used as test gases. G.Y.

N79-22431# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

COUPLED INTERACTIONS OF SHOCK-WAVE STRUCTURE WITH LAMINAR BOUNDARY LAYER IN IONIZING-ARGON SHOCK-TUBE FLOWS

K. Takayama and W. S. Liu Mar. 1979 66 p refs
(Grant AF-AFOSR-3303-77)
(UTIAS-233; CN-ISSN-0082-5255) Avail: NTIS HC A04/MF A01

Analyses are made of the mutual interactions between shock structure and the sidewall laminar boundary layer and their effects on the quasi-steady flat plate laminar boundary layer in ionizing argon shock tube flows. The mutual interactions are studied using effective quasi-one-dimensional equations derived from an area-averaged-flow concept in a finite-area shock tube. The effects of mass, momentum and energy non-uniformities and the wall dissipations in the ionization and relaxation regions on the argon shock structure are discussed. The new results obtained for shock structure, shock tube laminar side wall and quasi-steady flat plate boundary layer flows are compared with dual-wavelength interferometric data obtained from the UTLAS 10 cm x 18 cm hypervelocity shock tube. It is shown that the difference between the results obtained from the present method are significant for lower shock Mach numbers where the relaxation lengths are large. Author

N79-22432*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

INCORPORATION OF COUPLED NONEQUILIBRIUM CHEMISTRY INTO A TWO-DIMENSIONAL NOZZLE CODE (SEAGULL) Final Report

Alan W. Ratliff Apr. 1979 55 p refs
(Contract NAS1-14754)
(NASA-CR-3121) Avail: NTIS HC A04/MF A01 CSCL 20D

A two-dimensional multiple shock nozzle code (SEAGULL) was extended to include the effects of finite rate chemistry. The basic code that treats multiple shocks and contact surfaces was fully coupled with a generalized finite rate chemistry and vibrational energy exchange package. The modified code retains all of the original SEAGULL features plus the capability to treat chemical and vibrational nonequilibrium reactions. Any chemical and/or vibrational energy exchange mechanism can be handled as long as thermodynamic data and rate constants are available for all participating species. G.Y.

N79-22433*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.

EFFECTS OF PRECURSOR HEATING ON RADIATING AND CHEMICALLY REACTING VISCOUS FLOW AROUND A JOVIAN ENTRY BODY Final Report, 1 Feb. 1978 - 31 Mar. 1979

S. N. Tiwari and K. Y. Szema May 1979 183 p refs
(Grant NsG-1492)
(NASA-CR-158344) Avail: NTIS HC A09/MF A01 CSCL 20D

The influence of changes in the precursor region flow properties (resulting from absorption of the radiation from the shock layer) on the entire shock-layer flow phenomena around a Jovian entry body is investigated under physically realistic conditions. In the precursor region, the flow is considered to be inviscid and the variations in flow properties are determined by employing the small perturbation technique as well as the thin-layer approximation. The flow in the shock layer is assumed to be steady, axisymmetric, and viscous. The analysis is carried out by considering both the chemical equilibrium and nonequilibrium composition of the shock-layer gas. The effects of transitional range behavior (slip boundary conditions on the body surface and at the shock wave) are included in the analysis of high altitude entry conditions. G.Y.

N79-22434*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

CTS-TYPE VARIABLE CONDUCTANCE HEAT PIPES FOR SEP FM/PPU Final Report, Oct. 1977 - Dec. 1978

D. Antoniuk and E. E. Luedke Dec. 1978 45 p
(Contract NAS3-21130)
(NASA-CR-159550; TRW-30979-6003-RU-00) Avail: NTIS HC A03/MF A01 CSCL 20D

The development effort for, and the fabrication and testing of, six CTS-type variable conductance heat pipes is described. The heat pipes are constructed of stainless steel, use methanol as a working fluid, and a nitrogen/helium mixture as the control gas. The wicking structure consists of interior wall grooves, a metal-felt diametral slab wick, and two wire-mesh arteries. The heat pipes are used to cool two Functional Model/Power Processing Units in a Solar Electric Propulsion prototype BIMOD thruster subsystem assembly. The Power Processing Units convert the electric power from a spacecraft solar array system to the voltages required to operate the electric thrusters which are part of the BIMOD assembly. G.Y.

N79-22435# Stanford Univ., Calif. Inst. for Plasma Research.

SIMULATION OF THREE-DIMENSIONAL TURBULENT FLOWS WITH A VORTEX-IN-CELL METHOD

Benott Couet, Oscar Buneman, and Anthony Leonard Jan. 1979 38 p
(Contract N00014-78-C-0272)
(AD-A064175; SU-IPR-715) Avail: NTIS HC A03/MF A01 CSCL 20/4

A new method for the numerical simulation of three-dimensional incompressible flows is described. The vortex-in-cell (VIC) method traces the motion of the vortex filaments in the velocity field these filaments create on an Eulerian mesh via the fast integration of a Poisson equation. By incorporating the viscous or subgrid-scale effects into a filtering procedure, the computed scales of motion are assumed to be essentially inviscid. Results on tracing a periodic array of single vortex rings are compared with a Green's function calculation. Author (GRA)

N79-22436# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

THE INTERACTION OF MONOATOMIC AND DIATOMIC MOLECULES WITH SOLID SURFACES Interim Report, 1 Oct. 1977 - 30 Sep. 1978

Leon Trilling, Harold Y. Wachman, Robert B. Doak, Giusepp Gobbini, and David D. Dreyfuss Jan. 1979 33 p refs Presented at the 11th Intern. Symp. in Rarefield Gas Dyn.
(Contract F44620-76-C-0036; AF Proj. 2307)
(AD-A064784; AFOSR-77-0070TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The research conducted under contract F44620-76-C-0036 in the year 1978 is well described by the three papers presented at the XIth International Symposium on Rarefied Gas Dynamics. We submit them in lieu of an interim scientific report. Author (GRA)

N79-22437# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

HUFF, A ONE-DIMENSIONAL HYDRODYNAMICS CODE FOR STRONG SHOCKS M.S. Thesis
David J. Peters Dec. 1978 107 p refs
(AD-A063481; AFIT/GNE/PH/78D-9) Avail: NTIS HC A06/MF A01 CSCL 18/3

HUFF is a one-dimensional Lagrangian hydrodynamics computer code developed from the basic principles of mass, momentum, and energy conservation for strong shock propagation in a solid or gas. Two equations of state are used - the adiabatic ideal gas law with a variable gamma and the Gruneisen solid equation of state with a constant Gruneisen ratio. The Richtmyer and Morton difference equations for strong shocks are used on a spatial mesh composed of up to 100 cells. Results for two problems are presented which show the usefulness and limitations of the code and also serve as sample problems. The results of a one kiloton nuclear explosion are compared to the Nuclear Blast Standard 1KT. The results were within 13 percent for shock overpressure and overdensity, 5 percent for shock material velocity, and 2 percent for shock position over a range of 20 meters to 2 kilometers from the burst point. The larger deviations occurred at early times being attributed to an absence of radiation transport calculations in the code. The second problem, a megabar compression of uranium, shows agreement within two percent for all parameters (peak shock pressure, density, material velocity and shock velocity) when compared with the Rankine-Hugoniot compression curves. The equation of state for a solid was limited to calculations below 100 megabars due to its simplicity and constant value for the Gruneisen ratio. A complete users guide and program listing are also provided.
Author (GRA)

N79-22438# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON THE APPLICABILITY OF DIRECTED FLUID JETS TO NEWTONIAN AND NON-NEWTONIAN FLOWS
P. M. Naghdi Jan. 1979 53 p refs
(Contract N00014-76-C-0474)
(AD-A065132; UCB/AM-79/1) Avail: NTIS HC A04/MF A01 CSCL 20/4

This paper elaborates on the applicability of a direct formulation of the theory of jets to Newtonian and non-Newtonian fluid flow problems. Following a general discussion of the nature of direct theories, we record the basic equations of the theory of directed curves for any finite number of directors. Reference is then made to some recent results for incompressible Newtonian viscous flows, including the problem of jet breakup. The major portion of the paper is concerned with application of the direct approach to an incompressible non-Newtonian Poiseuille flow in a circular pipe. The results are compared to those of the three-dimensional theory and are found to include the effect of normal force corresponding to the normal stress effect.
Author (GRA)

N79-22439# Tetra Tech, Inc., Pasadena, Calif.
NONLINEAR THEORY FOR PARTIALLY CAVITATING CASCADE FLOWS Technical Report, 15 Feb. - 15 Oct. 1978
Okitsugu Furuya Sep. 1978 47 p refs
(Contract N00014-78-C-0146)
(AD-A064132; TETRAT-TC-3951-01) Avail: NTIS HC A03/MF A01 CSCL 20/4

A nonlinear theory for solving partially cavitating cascade problems was formulated in two different types of input data set-ups, one specifying cavitation number and the other the cavity length. The second method was necessary to find a unique solution because the cavity length has two different values for a specified cavitation number in some blade geometry cases. This fact, together with the investigation of detailed pressure distributions on the upper wetted part of the blade, explained the unsteady cavity phenomena previously reported in some experiments. Suggestions were made on how to avoid the occurrence of the unsteady partial cavity phenomena when one designs fluid machinery used in a partially cavitating regime.
Author (GRA)

N79-22440# New York Univ., N. Y. Dept. of Applied Science.
A NONLINEAR STABILITY APPROACH TO BOUNDARY-LAYER TRANSITION DATA ANALYSIS Final Report, 1 Apr. 1977 - 14 Apr. 1978
Roberto Vaglio-Laurin Dec. 1978 46 p refs
(Grant AF-AFOSR-3359-77)
(AD-A064645; AFOSR-79-0023TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Findings and conclusions of a brief, seven month, effort on fundamental aspects of boundary-layer transition analysis and prediction are reported. Starting from the linear forced response/stability theories of Mack, the capabilities of the attendant maximum allowable linear disturbance amplitude criteria are examined in the context of selected transition experiments. Evidence of distinct nonlinear effects is found in the growth process of internal boundary-layer disturbances having small but finite amplitude heretofore assumed to fall within the realm of linear theory. The flow processes responsible for this behavior are identified, the formulation of an attendant nonlinear model differing from classical weakly nonlinear stability theory is set forth, and preliminary predictions, apparently explaining the complex multi-region stability diagram observed in recent experiments by Demetriades, are presented. An important role of nonlinear flow processes and models is suggested for transition data analyses/predictions and an approach to elaboration of such models is outlined.
Author (GRA)

N79-22441# Tetra Tech, Inc., Pasadena, Calif.
COMPUTER PROGRAM FOR CALCULATING PARTIALLY CAVITATING CASCADE FLOWS IN NONLINEAR THEORY Technical Report, 15 Feb. 1978 - 15 Jan. 1979
Okitsugu Furuya Jan. 1979 129 p refs
(Contract N00014-78-C-0146)
(AD-A064743; TETRAT-TC-3951-02) Avail: NTIS HC A07/MF A01 CSCL 20/4

A nonlinear theory for solving partially cavitating cascade problems was formulated in two different types of input data set-ups, one specifying cavitation number and the other the cavity length. The second method was necessary to find a unique solution because the cavity length has two different values for a specified cavitation number in some blade geometry cases. The report describes the structure of program including various subroutines, input data set-up, typical output data and listing.
Author (GRA)

N79-22442# RAND Corp., Santa Monica, Calif.
LOW SPEED BOUNDARY-LAYER TRANSITION WORKSHOP, 2
William S. King and Mari Yokota Jan. 1978 294 p
(Contract N00014-76-C-0852)
(AD-A064372; RAND/R-P-6119) Avail: NTIS HC A13/MF A01 CSCL 20/4

Major subject areas discussed include: Numerical Investigations of Navier-Stokes Equation; Transition and Stability Theory; Predictions of Transition by Model Equations; The Effects of Free Stream Disturbances and Surface Roughness on Transition; Experimental Investigations of Transition; and The Design and Parametric Studies of Laminar Flow Bodies. GRA

N79-22443# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
SHIP-E, A COMPUTER IMPLEMENTATION OF THE FINITE-DIFFERENCE EMBEDDING METHOD OF ABLATION ANALYSIS
J. D. Randall May 1978 93 p refs Sponsored in part by DOE
(Contract N00024-78-C-5384)
(AD-A064659; APL/JHU-CP-067; DOE/ASMP-3060-16) Avail: NTIS HC A05/MF A01 CSCL 09/2

PL/I procedures have been developed that use finite-difference techniques to analyze ablation problems by embedding them in inverse heat-conduction problems with no moving boundaries. The procedures form a set of subroutines that can be called from a problem-oriented main program written by the user. The procedures include provisions for one-, two-, or three-dimensional conduction, parallel modes of heat transfer, thermal contact, choices of implicit- and explicit-difference techniques, temperature-dependent and directional thermal properties, radiation relief, aerodynamic heating, chemical ablation and material removal from combinations of flat, cylindrical, and spherical surfaces. This

report is meant to serve as a source of underlying theory not covered elsewhere and as a user's manual for PL/I procedures. Also included are useful debugging aids and external identifiers, a directory of Applied Physics Laboratory computer libraries pertaining to the PL/I procedures, and an illustrative problem as an example. Author (GRA)

N79-22444# Argonne National Lab., Ill.
CRITICAL HEAT FLUX UNDER TRANSIENT CONDITIONS: A LITERATURE SURVEY
J. C. M. Leung Jun. 1978 63 p refs
(Contract W-31-109-ENG-38)
(NUREG-CR-0056; ANL-78-39) Avail: NTIS HC A04/MF A01

An extensive literature survey of transient critical heat flux (CHF) studies in forced convective boiling system is made. It includes both domestic and foreign works and covers three main types of transient: flow decay, power excursion and depressurization (blowdown) transients. The first part of the report surveys the transient CHF correlations and physical models and the second part summarizes experimental investigations. In the latter portion, much attention is given to the blowdown studies related to the loss-of-coolant accident in both light- and heavy-water reactors. The influence of various system parameters on time to CHF during the blowdown is summarized. DOE

N79-22445# Research Triangle Inst., Research Triangle Park, N. C.
INVESTIGATION OF FLOW RATE CALIBRATION PROCEDURES ASSOCIATED WITH THE HIGH VOLUME METHOD FOR DETERMINATION OF SUSPENDED PARTICULATES Final Report, 1976 - 1977
F. Smith, P. S. Wohlschlegel, R. S. C. Rogers, and D. J. Mulligan (North Carolina State Univ. at Raleigh) Aug. 1978 162 p
(Contract EPA-68-02-2277)
(PB-291386/1; EPA-600/4-78-047) Avail: NTIS HC A08/MF A01 CSCL 14B

Determination of total suspended particulate (TSP) in the ambient air by the high-volume method requires three independent measurements, mass of particulate collected, sampling flow rate, and sampling time. Several potential sources of error in each of the three above measurements identified. The purpose of this project was to investigate potential sources of error in the flow rate calibration used in making TSP measurements using the EPA reference method. GRA

N79-22446# National Technical Information Service, Springfield, Va.
FLUID CONTROL DEVICES, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1972 - Feb. 1979
Guy E. Habercom, Jr. Mar. 1979 275 p Supersedes NTIS/PS-78/0189; NTIS/PS-77/0181; NTIS/PS-76/0140; NTIS/PS-75/205
(NTIS/PS-79/0119/2; NTIS/PS-78/0189; NTIS/PS-77/0181; NTIS/PS-76/0140; NTIS/PS-75/205) Avail: NTIS HC $28.00/MF $28.00 CSCL 13G

The design, fabrication, application, and performance of fluidic and flueric control devices are described in these Government-sponsored research report. GRA

N79-22447# National Technical Information Service, Springfield, Va.
FLUID CONTROL DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Feb. 1979
Guy E. Habercom, Jr. Mar. 1979 350 p Supersedes NTIS/PS-78/0190; NTIS/PS-77/0182; NTIS/PS-76/0141
(NTIS/PS-79/0120/0; NTIS/PS-78/0190; NTIS/PS-77/0182; NTIS/PS-76/0141) Avail: NTIS HC $28.00/MF $28.00 CSCL 13G

The design, fabrication, application, and performance of fluidic and flueric control devices are described in these abstracts of reports gathered in a worldwide literature survey. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-22448*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASURING UNSTEADY PRESSURE ON ROTATING COMPRESSOR BLADES
David R. Englund, Howard P. Grant (Pratt and Whitney Aircraft, East Hartford, Conn.), and George A. Lanati (Pratt and Whitney Aircraft, East Hartford, Conn.) 1979 28 p refs Presented at the 25th Intern. Instrumentation Symp., Anaheim, Calif., 7-10 May 1979, sponsored by the Instr. Soc. of Am.
(NASA-TM-79159; E-015) Avail: NTIS HC A03/MF A01 CSCL 14B

Miniature semiconductor strain gage pressure transducers mounted in several arrangements were studied. Both surface mountings and recessed flush mountings were tested. Test parameters included mounting arrangement, blade material, temperature, local strain in the acceleration normal to the transducer diaphragm, centripetal acceleration, and pressure. Test results show no failures of transducers or mountings and indicate an uncertainty of unsteady pressure measurement of approximately + or - 6 percent +0.1 kPa for a typical application. Two configurations were used on a rotating fan flutter program. Examples of transducer data and correction factors are presented. Author

N79-22449# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
HOLOGRAPHIC OPTICS FOR MISSILE GUIDANCE SYSTEMS
B. D. Guether and C. D. Leonard 20 Dec. 1978 29 p refs
(AD-A064354; DRDMI-T-79-12) Avail: NTIS HC A03/MF A01 CSCL 17/8

This report briefly compares holographic optics to more conventional optics and points out some of the advantages of using holographic optics in missile guidance systems. It describes the construction of two optical systems used to demonstrate some of the advantages of holographic optics. Author (GRA)

N79-22450# Utah State Univ., Logan. Electro-Dynamics Lab.
INCREASING THE THROUGHPUT OF HADAMARD SPECTROMETERS BY THE USE OF CURVED SLOTS
Roy W. Esplin, George A. Vanasse, Doran J. Baker, and Ronald J. Huppi 22 Sep. 1978 321 p refs
(Contract F19628-77-C-0203; AF Proj. 2310)
(AD-A064198; EDL-SRL-78-2; AFGL-TR-78-0232; SR-1) Avail: NTIS HC A14/MF A01 CSCL 20/6

This report proves that the optical throughput of Hadamard spectrometers can be significantly increased by using curved rather than straight slots. The slot curvature for a representative Hadamard spectrometer is optimized. For this Hadamard spectrometer the throughput is increased by a factor of ten by using optimally curved slots instead of straight slots. Analytic and ray-tracing methods are used to optimize the slot curvature. Experimental measurements with both straight and optimally curved slots are given for comparison. Ammonia absorption spectra taken in the 9 to 13-micrometers wavelength interval using 20-mm tall curved slots are given. Author (GRA)

N79-22451# Eikonix Corp., Burlington, Mass.
DESIGN AND FEASIBILITY STUDY OF AN OFF-LINE DIGITAL ORTHOPRINTER FOR FIELD USE Final Report, 30 Aug. 1977 - 30 Apr. 1978
Sep. 1978 94 p
(Contract DAAK70-77-C-0196)
(AD-A064818; EC/2107301-FR) Avail: NTIS HC A05/MF A01 CSCL 14/5

A van-mounted off-line orthoprinter suitable for field use is

required. A digital orthoprinter provides a simpler and more rugged system design compared to the complex and sensitive hardware systems commercially available. This program was performed to evaluate the feasibility of an off-line digital orthoprinter that provides the required ruggedness and the speed and accuracy for orthophotos. In pursuance of this program EIKONIX formulated a system concept that employs a drum scanner writer for the van-mounted digital orthoprinter. Available rectification and differential rectification algorithms were implemented during this program to evaluate distortion parameters expected from camera systems. These distortion parameters were required inputs for design of the drum scanner with a solid state linear array. This work demonstrates that the digital, drum scanner design approach meets the objectives for orthophoto production in the field. Author (GRA)

N79-22452# National Bureau of Standards, Washington, D. C. Fluid Engineering Div.
LOW VELOCITY PERFORMANCE OF A JEWEL BEARING VANE ANEMOMETER Report, 1 Apr. - 31 May 1977
L. P. Purtell Sep. 1978 22 p refs
(Contract DI-BM-HO-166098)
(PB-291410/9; NBSIR-78-1524) Avail: NTIS HC A02/MF A01 CSCL 14B

Performance of a jewel bearing vane anemometer is evaluated over the speed range of 60.6 to 752 feet per minute including starting and stopping speed. The tests were performed in the NBS Low Velocity Airflow Facility which provides a uniform flow of low turbulence and uses a laser velocimeter as the velocity standard. The rotary vane anemometer tested for this report is a commercially available instrument used in the mining industry and elsewhere as a portable anemometer. GRA

N79-22453# National Bureau of Standards, Washington, D. C. Fluid Engineering Div.
LOW VELOCITY PERFORMANCE OF A HIGH SPEED VANE ANEMOMETER Report, 1 Jun. - 31 Jul. 1977
L. P. Purtell Sep. 1978 24 p refs
(Contract DI-BM-HO-166198)
(PB-291409/1; NBSIR-78-1545) Avail: NTIS HC A02/MF A01 CSCL 14B

Performance of a high speed vane anemometer is evaluated over the speed range of 43.4 to 741 feet per minute including starting speed and stopping speed. The tests were performed in the NBS Low Velocity Airflow Facility which provides a uniform flow of low turbulence and uses a laser velocimeter as the velocity standard. The rotary vane anemometer tested is a commerically available instrument used in the mining industry and elsewhere as a portable anemometer. GRA

N79-22454# National Bureau of Standards, Washington, D. C. Fluid Engineering Div.
LOW VELOCITY PERFORMANCE OF A BRONZE BEARING VANE ANEMOMETER Task Report, 1 Dec. 1976 - 28 Feb. 1977
L. P. Purtell Feb. 1978 27 p ref
(Contract DI-BM-HO-166198)
(PB-291366/3; NBSIR-78-1433) Avail: NTIS HC A03/MF A01 CSCL 14B

Performance of bronze bearing vane anemometer is evaluated over the speed range of 64 to 690 feet per minute including starting speed and stopping speed. The tests were performed in the NBS Low Velocity Airflow Facility which provides a uniform flow of low turbulence and uses a laser velocimeter as the velocity standard. The rotary vane anemometer tested for this report is a commercially available instrument used in the mining industry and elsewhere as a portable anemometer. It was supplied for test by the U.S. Mining Enforcement and Safety Administration (MESA) at the request of the U.S. Bureau of Mines. GRA

N79-22151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON IMPROVED RANGING, 2
J. W. Layland and A. I. Zygielbaum *In its* The Deep Space Network 15 Apr. 1979 p 68-73 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-22455*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER DOPPLER VELOCIMETRY WORKSHOP
Robert B. Owen Mar. 1979 12 p Workshop held at Huntsville, Ala., 12 Feb. 1979
(NASA-CP-2084) Avail: NTIS HC A02/MF A01 CSCL 20E

The potential of laser Doppler velocimetry as a technique for use in mapping flows in the several fluid systems under development for doing research on low-gravity processes, is investigated. Laser Doppler velocimetry techniques, equipment, and applications are summarized. J.M.S.

N79-22456# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SYNTHESIS OF THE PLASMA CHEMISTRY OCCURRING IN HIGH POWER CO2 LASERS M.S. Thesis
David E. Toodle Dec. 1978 94 p refs
(AD-A064756; AFIT/GEP/PH/78D-13) Avail: NTIS HC A05/MF A01 CSCL 20/5

The neutral chemistry of the following mixtures have been studied by using a quadrupole mass spectrometer and a theoretical model: CO2/Ar, N2/Ar, CO2/N2/Ar, CO2/He/Ar, and CO2/N2/He/Ar. CO2 dissociation occurs by direct electron impact and appears to depend on initial CO2 concentration and mixture. Very little N2 dissociation occurs in a pure N2 discharge; however, dissociation of N2 increases when it is added to a mixture containing CO2. This dissociation is less than 1%. Consequently, the dominant nitrogen oxide in mixtures containing CO2 and N2 is NO, and the concentration of NO never exceeds 1%. The species CHO and CH2O are present at high discharge currents if there is a small amount of water contamination in mixtures containing CO2. Author (GRA)

N79-22457# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TEMPORAL EVOLUTION OF THE MERCURY-CHLORIDE DISCHARGE M.S. Thesis
William R. Ercoline Dec. 1978 90 p refs
(AD-A064755; AFIT/GEP/PH/78D-2) Avail: NTIS HC A05/MF A01 CSCL 20/5

Computational simulations of the HgCl discharge are discussed. Equations that model the laser are solved simultaneously as functions of time. The discharge model includes electron losses by dissociative attachment and dissociative recombination. Electron sources are direct electron beam ionization and ionization from the excitation of the atomic species. The excitation and ionization rates are obtained from solutions to the electron Boltzmann equation which includes the following processes: inelastic collisions of the first and second kind, heating by the electric field, secondary production by the electron beam, and electron-electron collisions. GRA

N79-22458# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
LASER DIAGNOSTICS IN METALLIC PLASMAS Final Report, 1 Jun. 1974 - 31 Oct. 1978
David R. Bach Dec. 1978 65 p refs
(Grant AF-AFOSR-2713-74; AF Proj. 2301)
(AD-A064846; AFOSR-79-0044TR) Avail: NTIS HC A04/MF A01 CSCL 20/9

The major objectives of the research described was the study of diagnostic techniques for metallic plasmas produced by exploded wire systems. Work accomplished included the development of a diamond die for the extrusion of lithium, ray tracing calculations to determine the deflection and absorption of rays passing through the plasma, and a transmission line calculation used for the design of etalons. Measurements made include X-ray temperature determinations by the line ratio method using scintillator detectors. Experiments were also carried out on a large area CdS detector for the measurement of infrared radiation. A two-wavelength holographic interferometer was designed, constructed, tested, and used for the measurement of density distribution in the exploded wire plasma and a Z-pinch.

The useful measurements were made with the system at the ruby doubled frequency, as the transmission through the plasma was greater at this wavelength. The exploded wire system has been modified to accept solid wires of tungsten and aluminum which can be fed from outside the vacuum system and a new X-ray measuring system has been constructed. Author (GRA)

N79-22459# Battelle Columbus Labs., Ohio.
PULSED LASER INTERACTIONS WITH TITANIUM-VANADIUM ALLOYS Final Report, 14 Apr. 1975 - 8 Aug. 1978
A. H. Clauer and B. P. Fairand 15 Feb. 1979 28 p refs
(Grants DAHC04-75-G-0115; DAAG29-77-G-0187)
(AD-A065143; ARO-12794.2-MS) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of a high energy pulsed laser induced shock wave on the properties and microstructure of a series of titanium vanadium alloys were investigated. The peak pressure of the shock waves was increased by using high acoustic impedance back-up plates and by splitting the laser beam to shock two opposite sides of the specimen simultaneously. The hardness and strength of the alloys were increased up to 10 percent after laser shocking. The shock hardening was attributed to shock induced dislocations and twinning, and possibly strain transformed metastable beta depending on alloy composition and heat treatment. The magnetic susceptibility of the alloys was unaffected by laser shocking. Author (GRA)

N79-22460# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYSIS OF THE EFFECTS OF SPECKLE ON LASER SCANNING SYSTEMS M.S. Thesis
Billy W. Newton, Jr. Dec. 1978 106 p refs
(AD-A064048; AFIT/GEO/EE/78-3) Avail: NTIS HC A06/MF A01 CSCL 17/8

The effects of speckle on an imaging system composed of a laser scanning a rough surface and a receiver measuring the reflected field are examined. Three types of lasers and two types of receivers are considered. The lasers are designated by their bandwidths as monochromatic, quasimonochromatic, and broadband. The receivers are the heterodyne and direct detection. A second moment model is obtained for each system. The system consisting of a broadband laser and direct detection receiver is shown to be independent of speckle effects. All other systems are shown to have a noise, due to speckle, which is signal dependent. The signal to noise ratio for the direct detection system is shown to be higher than for the heterodyne systems. The system with broadband lasers are found to have a higher resolution than systems with other laser sources. GRA

N79-22461# Texas A&I Univ., Kingsville.
SCATTER PROPERTIES OF mld MIRRORS Final Report, 1 Jun. - 30 Nov. 1978
T. Joe Boehm 31 Jan. 1979 34 p
(Grant AF-AFOSR-3660-78; AF Proj. 2305)
(AD-A064750; AFOSR-79-0034TR) Avail: NTIS HC A03/MF A01 CSCL 20/6

A study and development of data processing techniques for spatial scatter intensity data from a MLD mirror was undertaken. Several processing schemes were investigated with the result that processing the data so as to produce a true and scaled polar plot of the scatter field seems to be the optimum way of displaying the information. Studies of the scatter field of a particular MLD mirror did not support the notion that lobes are to be found in the pattern. On the contrary, the scatter field is more accurately described as a random spatial function. In addition, studies of the processed data patterns suggest that a possible measure of mirror quality may be had by direct comparison of its forward and back scatter characteristics. Author (GRA)

N79-22462# Naval Research Lab., Washington, D. C.
LASER PLASMA INTERACTION AND ABLATIVE ACCELERATION OF THIN FOILS AT 10 TO THE 12TH POWER - 10 TO THE 14TH POWER W/SQ. cm
29 Dec. 1978 54 p refs
(AD-A063814; NRL-MR-3890) Avail: NTIS HC A04/MF A01 CSCL 20/5

The interaction physics and hydrodynamic motion of thin-foil targets irradiated by long, low-flux Nd-laser pulses (3 nsec, 10 to the 12th power to 7 x 10 to the 14th power W/sq.cm) are studied experimentally and compared with theoretical models. Laser light absorption is high (80-90%) and thin-foil targets are accelerated up to about 10 to the 7th power cm/sec with good (about 20%) hydrodynamic efficiency in the 10 to the 12th power to 10 to the 14th power W/sq.cm range. These results agree with a simple rocket ablation model. Details of thermal heat flow both axially (related to ablation depth) and laterally (related to beam uniformity requirements) are also presented. Author (GRA)

N79-22463# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
CHEMICAL LASER FUELS, 1. REACTIONS BETWEEN ACTIVE CALCIUM AND SELECTED GASES, 2 Progress Report, Jun. 1974 - Jul. 1977
P. Martignoni, O. E. Ayers, J. A. Murfree, H. A. Nappier, and W. M. Che 3 May 1978 49 p refs
(AD-A063763; DRDMI-T-78-46) Avail: NTIS HC A03/MF A01 CSCL 20/5

The primary objective of the work performed by the Propulsion Directorate, Technology Laboratory, was to avoid the storage and handling hazards associated with high pressure or liquid hydrogen by developing an all-solid propellant composition which, upon ignition, can supply the hydrogen gas for a chemical laser. This solid propellant gas generator will provide a completely storable hydrogen gas source that combines instant readiness with excellent handling behavior and compact storage. GRA

N79-22464# School of Aerospace Medicine, Brooks AFB, Tex.
EVALUATION OF LASER-PROTECTION EYEWEAR Final Report, Feb. 1974 - Feb. 1978
Ross Murray, Jr., Daniel Murray, John Taboada, Garrett D. Polhamus, and Ralph G. Allen Oct. 1978 131 p refs
(AF Proj. 7757)
(AD-A064255; SAM-TR-78-30) Avail: NTIS HC A07/MF A01 CSCL 20/5

Forty-one commercially available laser-protection eyewear, ten representative frames, and nine Air Force-developed protectors were evaluated under nonstress and stress conditions. Optical density, luminous transmittance, refractive and prismatic effects, haze, metrology, and optical quality were measured and when applicable, compared to ANSI standards. In addition, all materials were subjected to shelf-life, environmental effects, and laser-induced damage tests to determine damage limits and characteristics. The testing methodology, experimental apparatus, structural and spectral changes in the materials, and observations on type and cause of damage are presented. Author (GRA)

N79-22465# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EVALUATION OF ERRORS IN A PASSIVE RING RESONATOR LASER GYROSCOPE M.S. Thesis
David J. Olkowski and Charles R. Holland Dec. 1978 77 p refs
(AD-A064046; AFIT/GA/EE/78-2) Avail: NTIS HC A05/MF A01 CSCL 20/5

The passive ring resonator laser gyroscope is a new approach to measuring inertial rotation. This approach is based upon the Sagnac effect and uses a passive ring Fabry-Perot interferometer as the rotation sensing element. This report contains the results of a series of tests which were accomplished on a passive ring resonator laser gyroscope. The report contains a detailed description of this device plus a description of each test performed. These tests include noise measurements, inertial rotation measurements, and bias measurements. The test results show that the relationship between the output frequency and input rotation rate is linear and is consistent with previously published data indicating no lock-in problem. The output bias is shown to be affected by piezoelectric transducer position and by differences in intensity between the counter rotating light beams. Additionally, the difference in intensity also is shown to affect the noise content of the output. These significant new results lead to a recommendation to improve the performance of this new type of gyroscope via the addition of an intensity feedback control loop. GRA

N79-22466# Aerospace Corp., El Segundo, Calif.
DESIGN AND PERFORMANCE OF FLOWING-GAS ELECTRICAL-DISCHARGE CO2 LASERS
Dean T. Hodge and Frank B. Foote 27 Dec. 1978 39 p
(Contract F04701-78-C-0079)
(AD-A063919; TR-0079(4930-01)-1) Avail: NTIS HC A03/MF A01

This report describes the design and construction details of flowing-gas electric discharge CO2 lasers capable of 750 W TEM sub 00 output power in the 10 micrometers spectral range. Amplitude and frequency stability, lifetime considerations, and general maintenance of the laser are discussed. Detailed engineering drawings, optics requirements, and a parts list are included to facilitate replication. Author (GRA)

N79-22467# Air Force Academy, Colo. Research Lab.
EXPERIMENTAL INVESTIGATION OF XeF2 FOR POSSIBLE LASER APPLICATIONS Technical Report, 1 Dec. 1977 - 30 Sep. 1978
Ronald E. Channell, Larry P. Davis, and Kenneth E. Siegenthaler Dec. 1978 20 p refs
(AF Proj. 2303)
(AD-A063872; FJSRL-TR-78-0013) Avail: NTIS HC A02/MF A01 CSCL 20/5

The feasibility of the use of xenon difluoride as the oxidant for an HF or DF chemical laser system was investigated. The basic research that was accomplished to provide information for this study included spectral studies, photodissociation and thermal dissociation of the xenon difluoride. The absorption spectrum of xenon difluoride confirmed the literature result. Attempts to detect radical thermal or photodissociation products via electron spin resonance spectrometry were unsuccessful. Due to these negative results it was concluded that xenon difluoride would not be a good candidate for the oxidant in a chemical laser system. Author (GRA)

N79-22468# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Schooi of Engineering.
ANALYSIS OF AN INJECTION-LOCKED DYE RING LASER AMPLIFIER M.S. Thesis
James C. Vetter Dec. 1978 77 p refs
(AD-A064214; AFIT/GEP/PH/78D-15) Avail: NTIS HC A05/MF A01 CSCL 20/5

A rate equation model for an injection locked dye ring laser amplifier is derived. The amplifier is a design by A. Pease et al. The model is compared to work by G. Marowsky, C. Lin, and U. Ganiel et al and is shown to compare very well. The model is then used to analyze the amplifier. The conditions of the amplifier that are varied are the injected wavelength, delay time between the injection and pump pulses, and the mirror reflectivity. Results show that reabsorption of photons at the injected wavelength by the dye has significant effects on looking and that varying the mirror reflectivity partially alleviates this situation. The best delay times are found to be between 3 and 7 ns.
Author (GRA)

N79-22469# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYTIC ENERGY DISTRIBUTION FUNCTIONS FOR ELECTRIC DISCHARGE LASERS M.S. Thesis
Thomas E. Gist Dec. 1978 96 p refs
(AD-A064213; AFIT/GEP/PH/78D-4) Avail: NTIS HC A05/MF A01 CSCL 20/5

The Boltzmann equation for electrons is solved for background gases of one or two excited levels under conditions typical of electric discharge lasers. Reaction rates are assumed constant above a threshold energy, and the electron heating rate is assumed independent of energy. Elastic and superelastic collisions were not considered. Numerical solutions from a program developed in conjunction with Seward, Hastings, and Ercoline are in excellent agreement with the analytic solutions.
Author (GRA)

N79-22470# Hughes Research Labs., Malibu, Calif.
OPTICAL-MICROWAVE INTERACTIONS IN SEMICONDUCTOR DEVICES Quarterly Report, 1 Oct. 1978 - 31 Dec. 1978
Huan-Wun Yen and Luis Figueroa Jan. 1979 50 p refs
(Contract N00173-78-C-0192)
(AD-A064702; QR-2) Avail: NTIS HC A03/MF A01 CSCL 20/5

The feasibility of achieving optical injection locking of millimeter-wave IMPATT oscillators was investigated by calculating the efficiency of subharmonic optical injection locking of IMPATT oscillators. Calculations were carried out by adding a time-varying reverse saturation current term, which was generated by the incident optical signal, to the IMPATT avalanche equation. The results indicated that a locking range on the order of 100 MHz could be achieved for X-band IMPATT oscillators if modulated optical signal was converted into rf photocurrent efficiently. The injection-locking characteristics of X-band Si IMPATT oscillators were further investigated by measuring the locking range as a function of locking gain. Subharmonic locking was used with a frequency ratio ranging from 3:1 to 8:1. It was observed that a locking range of several megahertz was achievable with an oscillator at 8.11 GHz. It was also noted that even subharmonic locking was preferred over odd subharmonic locking for the oscillators. GRA

N79-22471# Indiana Univ. at Bloomington. Dept. of Chemistry.
TIME-RESOLVED FLUORIMETRY VIA A NEW CROSS-CORRELATION METHOD
J. M. Ramsey, G. M. Hieftje, and G. R. Haugen Jan. 1979 38 p refs
(Contract N00014-77-C-0444)
(AD-A064383) Avail: NTIS HC A03/MF A01 CSCL 01/2

A new instrument for the measurement fo short fluorescence lifetimes is discussed and characterized. The instrument is basically an implementation of the cross-correlation between the excitation source and the induced fluorescence response. Such an approach, with a mode-locked argon-ion laser as the source, is shown to be capable of measuring lifetimes as short as 80ps with a precision of 10ps. The instrument is simpler and less costly than others of similar capability. GRA

N79-22472# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
GYROSCOPE ERROR MODEL INVESTIGATION FOR THE SPERRY SLIC-15 RING LASER GYROSCOPE M.S. Thesis
Philip A. Renaud Dec. 1978 73 p refs
(AD-A064395; AFIT/GA/EE/78-5) Avail: NTIS HC A04/MF A01 CSCL 20/5

Power spectral density measurements from .001 to 8.33 Hz are made of the output noise of the SLG-15 laser gyroscope used in the SLIC-15 IMU manufactured by Sperry Gyroscope Company. A detailed discussion of the operation of the SLG-15 laser gyro is presented along with a description of its optical dither mechanism. The digital output of the gyroscope is analyzed using correlation techniques to characterize the noise. A description of the analysis technique and the test station used for the measurements is given along with representative samples of the output noise. Particular attention is paid to the effect of the dither mechanism on the output power density spectrum. The tests show that the low frequency noise due to dither is a characteristic of the dither mechanism and not a characteristic of a particular SLG-15 laser gyro. Based on the test data a linear low frequency model is constructed for both the dithered and undithered case. Author (GRA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-22473 Cincinnati Univ., Ohio.
INVESTIGATION OF LOW FREQUENCY PULSED GTA WELDING Ph.D. Thesis
Donald William Becker 1978 111 p
Avail: Univ. Microfilms Order No. 7904719

Low frequency pulsed gas tungsten arc (GTA) welding parameters were evaluated employing constant root bead width welds in Ti-8Al-1Mo-1V. The process parameter combinations were varied and the peak current required to maintain a constant

root bead width was determined by a trial and error method. The fraction of time at peak current, which is defined as the time at peak current divided by the cycle time, is shown to be a key process parameter. The solidification structures and the degree of segregation was evaluated in Ti-11.5Mo-7Zr-4.5Sn using optical microscopy and microprobe analysis. Full penetration constant root bead width welds and partial penetration constant heat input wleds were made. Grain size in full penetration Ti-8Al-1Mo-1V welds is shown to be unaffected by changes in pulsing parameters. Dissert. Abstr.

N79-22474* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

RETRACTABLE ENVIRONMENTAL SEAL Patent

Joseph R. Dettling, inventor (to NASA) (United Technologies Corp., Sunnyvale, Calif.) Issued 27 Mar. 1979 6 p Filed 29 Mar. 1978 Supersedes N78-22150 (16 - 13, p 1673) Sponsored by NASA

(NASA-Case-MFS-23646-1; US-Patent-4,146,180; US-Patent-Appl-SN-891372; US-Patent-Class-239-288; US-Patent-Class-239-265.15; US-Patent-Class-220-266; US-Patent-Class-277-192; US-Patent-Class-138-96R) Avail: US Patent and Trademark Office CSCL 11A

A retractable environmental seal for use in sealing the opening of the exit cone for a rocket nozzle is described. A diaphragm-like cover having a central region adapted to be seated in sealing relation with the periphery of the opening is discussed. Radially extended failure zones for facilitating a pressure-induced rupture of the cover, and a plurality of angularly spaced tension springs connected with the peripheral portion of the cover are characterized.

Official Gazette of the U.S. Patent and Trademark Office

N79-22475* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SHAFT SEAL ASSEMBLY FOR HIGH SPEED AND HIGH PRESSURE APPLICATIONS Patent

William F. Hadt and Lawrence P. Ludwig, inventors (to NASA) Issued 20 Mar. 1979 7 p Filed 8 Jul. 1977 Supersedes N77-27404 (15 - 18, p 2390)

(NASA-Case-LEW-11873-1; US-Patent-4,145,058; US-Patent-Appl-SN-814006; US-Patent-Class-277-62; US-Patent-Class-277-96.1) Avail: US Patent and Trademark Office CSCL 11A

A seal assembly is provided for reducing the escape of fluids from between a housing and a shaft rotably mounted in the housing. The seal assembly comprises a pair of seal rings resiliently connected to each other and disposed in side-by-side relationship. In each seal ring, both the internal bore surface and the radial face which faces away from the other seal ring are provided with a plurality of equi-spaced recesses. The seal faces referred to are located adjacent a seating surface of the housing. Under normal operating conditions, the seal assembly is stationary with respect to the housing, and the recesses generate life, keep the assembly spaced from the rotating shaft and allow slip therebetween. The seal assembly can seize on the shaft, and slip will then occur between the radial faces and the housing.

Official Gazette of the U.S. Patent and Trademark Office

N79-22476# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

TRANSONIC FLOWS IN TURBOMACHINERY. VOLUME 1: THEORY

1973 271 p refs Lecture held at Rhode-Saint-Genese, Belgium, 21-25 May 1973

(VKI-Lecture-Series-59-Vol-1) Avail: NTIS HC A12/MF A01

Theoretical discussions are presented of some fluid dynamic problems in turbomachinery. For individual titles, see N79-22477 through N79-22483.

N79-22477# Borg-Warner Corp., Des Plaines, Ill.

FUNDAMENTALS OF TIME-MARCHING METHODS

S. Gopalakrishnan *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 1 1973 24 p refs (For primary document see N79-22476 13-37)

Avail: NTIS HC A12/MF A01

In practice, the computation does not represent exactly the true physical evaluation of the flow. This inexactness arises principally due to two reasons. The first is related to the nature of the computational technique. The equations representing the physical flow are of the partial differential type and no analytical solutions of these are possible in general. Hence these differential equations are converted into algebraic finite difference equations. The solutions to the latter are not exact solutions and some inaccuracies appear. The magnitude of the errors is a function of the quality of the difference approximation. The second reason for inexactness is related to the complexities of a particular application. The features of various boundaries are often represented only approximately in the computation. L.S.

N79-22478# Borg-Warner Corp., Des Plaines, Ill.

APPLICATION OF THE TIME DEPENDENT TECHNIQUE TO TURBOMACHINERY CASCADES

S. Gopalakrishnan *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 1 1973 20 p refs (For primary document see N79-22476 13-37)

Avail: NTIS HC A12/MF A01

The three dimensional flow through an actual turbomachine can be conceptually split up into two parts: The flow in the meridional plane containing the radial and axial variation of flow properties and the flow in the blade-to-blade surface containing tangential and axial variations. The blade-to-blade surface is a surface of revolution and the classic approximation to this surface is a plane. The row of blades is represented on this plane as an infinite, periodic cascade. The time-dependent technique is applied to the computation of flow through such a two-dimensional cascade of blades. The flow is assumed to be inviscid and adiabatic. The computation scheme is general enough so that there is no Mach number limitations, and shock waves, if any, should appear automatically as part of the solution. The input to the computational program is the cascade geometry and the necessary flow boundary conditions. L.S.

N79-22479# AiResearch Mfg. Co., Phoenix, Ariz.

A TRANSONIC RELAXATION METHOD FOR CASCADE FLOW SYSTEMS

Paul R. Dodge *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 1 1973 30 p refs (For primary document see N79-22476 13-37)

Avail: NTIS HC A12/MF A01

Murman and Cole and Steger and Lomax developed a relaxation technique capable of handling rapidly and efficiently local patches of supersonic flow around isolated airfoils. The extension of the method to cascades, the comparison to data, and the limitations of the approach are the topics discussed. L.S.

N79-22480# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

CALCULATION OF TRANSONIC FLOW IN HIGH SOLIDITY CASCADES

R. A. VanDenBraembussche *In its* Transonic Flows in Turbomachinery, Vol. 1 1973 14 p refs (For primary document see N79-22476 13-37)

Avail: NTIS HC A12/MF A01

The method proposed is based on the flux analysis of Traupel and Oswatitsch and Ryhming and was developed by H. Griepentrog. The flow in high solidity cascades can be calculated as the flow in a long and narrow channel. The flow direction is imposed by the blade geometry and is almost not changing with Mach number. In the set of streamlines and equipotential lines only the position of the equipotential lines will change but their form will remain the same. In this calculation, the network of streamlines and equipotential lines are used as a curvilinear coordinate system. L.S.

N79-22481# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

CALCULATION OF COMPRESSIBLE SUBSONIC FLOW IN CASCADES WITH VARYING BLADE HEIGHT

R. A. VanDenBraembussche *In its* Transonic Flows in Turbomachinery, Vol. 1 1973 13 p refs (For primary document see N79-22476 13-37)

Avail: NTIS HC A12/MF A01

A singularity method is proposed to calculate the subsonic compressible flow in compressor and turbine cascades with constant or varying blade height. The method is an extension of an incompressible flow method by means of the Janzen-Rayleigh

theorem, using an exact relation between pressure and density. Theoretical results are compared with experimental data. L.S.

N79-22482# Ecole Royale Militaire, Brussels (Belgium). Dept. de Mecanique Applique.

SOLUTION OF TWO-DIMENSIONAL MIXED FLOWS USING POWER SERIES

R. Decuypere *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 1 1973 39 p refs (For primary document see N79-22476 13-37)

Avail: NTIS HC A12/MF A01

A survey is given of the most important methods based on series expansions of the velocity components. An equation which is used by several authors dealing with mixed flows is established. L.S.

N79-22483# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France).

DESIGN OF TRANSONIC TURBINE BLADES BY THE HODOGRAPH METHOD

G. Karadimas *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 1 1973 20 p refs (For primary document see N79-22476 13-37)

Avail: NTIS HC A12/MF A01

The problem dealt with may be formulated in the following terms: design of supercritical turbine blade profiles for moderate inlet Mach numbers (less than 0.7) and slightly supersonic exit Mach numbers (1.2 to 1.4) together with high efficiency and minimum variations in efficiency at off-design conditions. However, it should be pointed out that the method proposed is not confined to slightly supersonic flows only, but that it is equally valid for any exit Mach number. To solve the complete problem, a two-step method is used by means which, under certain hypotheses, a well-posed Dirichlet problem is solved in the subsonic region and thereafter a Cauchy problem to define the supersonic region. L.S.

N79-22484# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

TRANSONIC FLOWS IN TURBOMACHINERY. VOLUME 2: SAMPLE CALCULATIONS, COMPRESSOR TESTS

1973 183 p refs Lecture held at Rhode-Saint-Genese, Belgium, 21-25 May 1973

(VKI-Lecture-Series-59-Vol-2) Avail: NTIS HC A09/MF A01

The topics discussed include: the compressor blade definition; the cascade and stator section performance; calculated cascade performance of a DCA; and sample calculations. For individual titles, see N79-22485 through N79-22491.

N79-22485# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

THE COMPRESSOR BLADE DEFINITION

F. A. E. Breugelmans *In its* Transonic Flows in Turbomachinery, Vol. 2 1973 17 p refs (For primary document see N79-22484 13-37)

Avail: NTIS HC A09/MF A01

The following blade sections were chosen in a search for a compressor blade definition: (1) a supersonic DCA rotor section out of the tip region and not too close to the part span shroud; and (2) a high turning DCA stator section and out of the wake produced by the part span shroud. S.E.S.

N79-22486# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

THE CASCADE AND STATOR SECTION PERFORMANCE OF A 48 DEG CAMBERED DCA AIRFOIL, COMPARISON WITH 2D FLOW CALCULATIONS IN THE COMPRESSIBLE FLOW REGIME

F. A. E. Breugelmans *In its* Transonic Flows in Turbomachinery, Vol. 2 1973 15 p refs (For primary document see N79-22484 13-37)

Avail: NTIS HC A09/MF A01

A 48 deg double circular arc blade, typical for a transonic stage exit guide vane, was chosen for the transonic investigation. The comparison of the stator and cascade data with the computational methods is made at Mach numbers of 0.60 and 0.74 and at the choking conditions. Suction was applied in these experiments and the axial velocity-density ratio was changed. Good agreement with the calculations is obtained for the lower inlet Mach number. The exit flow conditions are overestimated for the turning angle and no attempt was made to give a loss prediction. Results indicate further experimental investigation is required in the transonic regime in order to produce more data for comparative purposes. S.E.S.

N79-22487# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).

CALCULATED CASCADE PERFORMANCE OF A DCA CASCADE WITH SUBSONIC AND SUPERSONIC INLET CONDITIONS

L. Fottner *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 2 1973 12 p refs (For primary document see N79-22484 13-37)

Avail: NTIS HC A09/MF A01

A method used with the physical background, the procedure of the FORTRAN program, and the limits in use of the method is described. The results of the calculations are presented in form of cascade characteristics, i.e. loss, outlet angle and static pressure rise as function of inlet conditions. The Reynolds number influence was investigated since the relevant figure of the measurements wasn't fixed at the time. The theoretical results with relevant data from a rotor section of a compressor stage designed and tested by NASA was compared. S.E.S.

N79-22488# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).

SAMPLE CALCULATION 2: PHI = 9 DEG 57, PHI = 48 DEG

W. Geller *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 2 1973 2 p refs (For primary document see N79-22484 13-37)

Avail: NTIS HC A09/MF A01

The calculation of the blade pressure distribution in compressible flow are presented. The method was developed for the pressure distribution on the complete profile contour. The exit flow angle for rounded blade trailing edges is computed. This exit flow direction is an input data for the improved Oswatitsch-Ryhming method. A good agreement between measured and computed exit flow direction cannot be expected. S.E.S.

N79-22489# Borg-Warner Corp., Des Plaines, Ill.

SAMPLE CALCULATION 3: PHI = 48 DEG

S. Gopalakrishnan *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 2 1973 2 p (For primary document see N79-22484 13-37)

Avail: NTIS HC A09/MF A01

The cascade at five inlet angles was analyzed with the exit Mach number held approximately constant at 0.5. The Mach number distributions on the surface as a function of axial chord was given. The choking flow of the cascade at given inlet angles was obtained. S.E.S.

N79-22490# Borg-Warner Corp., Des Plaines, Ill.

SAMPLE CALCULATION 4: PHI = 9 DEG 57

S. Gopalakrishnan *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 2 1973 2 p (For primary document see N79-22484 13-37)

Avail: NTIS HC A09/MF A01

The performance of the cascade at supersonic, transonic, and supersonic inlet Mach numbers was studied. An inlet tangential velocity, upstream tangential velocity and flow angle and a backpressure were obtained. S.E.S.

N79-22491# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).

SAMPLE CALCULATION 5: PHI = 9 DEG 57

H. Starken *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 2 1973 8 p refs (For primary document see N79-22484 13-37)

Avail: NTIS HC A09/MF A01

Two-dimensional cascade results which obtained in transonic and supersonic cascade wind tunnels are presented. Tests were carried out with three different blade shapes; these are double-circular-arc and wedge profiles. The influence of solidity on the performance of these cascades was investigated. A detailed

analysis and calculation of the shock losses shows the great influence of profile shape on the total pressure loss coefficient. The profile losses are roughly constant in the investigated Mach number range. Some measurements for different back pressures are presented. These results are analyzed with the aid of a simple calculation, which shows that the axial velocity-density ratio has to be considered as an important parameter in supersonic cascade measurements. S.E.S.

N79-22492# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TRANSONIC FLOWS IN TURBOMACHINERY. VOLUME 3: SAMPLE CALCULATIONS, TURBINE TESTS
1973 186 p refs Lecture held at Rhode-Saint-Genese, Belgium, 21-25 May 1973
(VKI-Lecture-Series-59-Vol-3) Avail: NTIS HC A09/MF A01

Sample calculations of the flow around a turbine blade are presented. Experimental data on turbine blade sections and comparison with various theoretical methods are included. For individual titles, see N79-22493 through N79-22505.

N79-22493# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE TURBINE BLADE DEFINITION
C. H. Sieverding *In its* Transonic Flows in Turbomachinery, Vol. 3 1973 3 p refs (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

Design objectives and methods are given for a gas turbine rotor blade section and a steam turbine rotor blade tip section. Cascade geometry and blade geometry are included. Local and complete flow separation from the blade surface of the gas turbine rotor blade section are studied. J.M.S.

N79-22494# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
EXPERIMENTAL DATA ON TWO TRANSONIC TURBINE BLADE SECTIONS AND COMPARISON WITH VARIOUS THEORETICAL METHODS
C. H. Sieverding *In its* Transonic Flows in Turbomachinery, Vol. 3 1973 33 p (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

Experimental data on two transonic turbine blade sections are presented and compared with various theoretical methods. Factors studied include: blade velocity distributions; inlet Mach number; outlet Mach number; and Reynolds number. Schlieren pictures and oil flow visualizations are given. J.M.S.

N79-22495# Avco Lycoming Div., Stratford, Conn.
SAMPLE CALCULATION 1
S. Gopalakrishnan *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 3 1973 8 p (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

The cascade was analyzed at a given inlet flow angle for three different exit Mach numbers. The overall performance is listed. The distribution of surface Mach number vs. axial chord is given for both suction and pressure surfaces. Plots of constant Mach number contours in steps of 0.05 for cases 1, 2, and 3 are presented. J.M.S.

N79-22496# Westinghouse Research Labs., Pittsburgh, Pa.
PREDICTION OF TRANSONIC CASCADE FLOWS FOR VKI-DESIGNED STEAM AND GAS TURBINE BLADES
C. L. S. Farn *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 3 1973 9 p (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

For a given blade geometry and its associated cascade parameters, a mathematical domain is specified. This mathematical domain is then divided into many overlapped finite-area elements and the unsteady compressible flow equations are solved for the fluid in each of the finite-area elements. The complete set of governing equations are given. The equations together with the appropriate initial and boundary conditions are sufficient to yield the transient solution for the four dependent variables. If the upstream and downstream boundary conditions are independent of time, the steady state solution may be obtained by integrating the equations for a large time period. The steady state solution is found to be independent of the initial conditions used in the integration. J.M.S.

N79-22497# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SAMPLE CALCULATION 4
R. Decuypere *In its* Transonic Flows in Turbomachinery, Vol. 3 1973 3 p refs (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

The calculations are carried out in the two dimensional channel formed by two adjacent blade sections and their front stagnation lines, which are assumed to be straight and parallel to the velocity vector of the incoming flow. It is assumed that the flow is steady, uniform at the inlet, adiabatic, inviscid, shock free, and irrotational. The channel is divided into three regions; the subsonic region; the throat region; and the supersonic region. In each region the steady partial differential equations are solved by a different technique. The velocity distribution over the transonic turbine tip section and the gas turbine rotor blade is depicted for the pressure and suction side. J.M.S.

N79-22498# Brown, Boveri and Co., Ltd., Baden (Switzerland).
SAMPLE CALCULATION 5
O. Novak *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 3 1973 16 p (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

The flow in the supersonic region of a transonic turbine cascade is calculated under conditions of limit loading. The basic assumptions are: (1) steady, adiabatic, two dimensional flow of inviscid perfect gas; (2) simplified form of the separated region behind the trailing edge; and (3) small curvature of trailing edge shocks. The problem to be solved, initial conditions, boundary conditions are given along with the method of solution, subdivision of calculation process, and computer type. J.M.S.

N79-22499# Central Electricity Generating Board, London (England). Engineering Labs.
SAMPLE CALCULATION 6
D. H. Wilkinson *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 3 1973 15 p refs (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

The blade surface pressure distribution and the Markov loss coefficient were calculated for the transonic tip section and the gas turbine section. Results obtained include: (1) blade surface pressure distributions, static/upstream total; (2) the sonic line; (3) the flow pattern of expansion and shock waves; and (4) the total pressure loss coefficient as a function of outlet Mach number M3, both at downstream infinity. J.M.S.

N79-22500# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Mulheim an der Ruhr (West Germany).
SAMPLE CALCULATION 7
J. Meyer *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 3 1973 10 p refs (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

The flow field of the cascade, calculated by the method of characteristics, is shown. The basic assumption are: (1) a straight sonic line represented by the shortest distance between two adjacent profiles; (2) at the separation points the flow directions are tangential to the blades surface on both sides of the profile; and (3) the influence of the friction on the outlet flow conditions has been estimated roughly. The results, presented in figures, were calculated without considering the flow with friction around the trailing edge and the interaction of the shock with a boundary layer on the suction side of the profile. J.M.S.

N79-22501# Rolls-Royce Ltd., Bristol (England). Engine Div.
SAMPLE CALCULATION 8
D. Carahar *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 3 1973 5 p ref (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

The prescribed velocity distributions method (PVD) utilized

to design blades is described. This system of design is found to be sufficiently accurate for blades with subsonic velocities at all points on the surfaces of the blades and also for blades with peak velocities in excess of the speed of sound up to Mach numbers of the order of 1.1. An analysis method to analyze blade shapes which were not produced by the PVD design method or for blades which had been designed by the PVD method but which were not exactly the shapes desired is considered. Results and notes on the analysis technique are presented. J.M.S.

N79-22502# Rolls-Royce Ltd., Bristol (England).
DEVELOPMENTS OF AN ANALYSIS METHOD FOR TWO-DIMENSIONAL, COMPRESSIBLE FLOW
D. P. Hope *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 3 1973 5 p ref (For primary document see N79-22492 13-37)
(GN-15661) Avail: NTIS HC A09/MF A01

A solution to the analysis of a turbine or compressor blade is described. The flow around a given profile at off-design conditions and the prediction of the velocity distribution around any section of a blade from hub to tip are features of the technique outlined. The theory of method used in the plane cascade analysis presented. J.M.S.

N79-22503# Rolls-Royce Ltd., Bristol (England). Turbomachinery Research Dept.
SOLUTION OF THE AERODYNAMIC ANALYSIS PROBLEM FOR VARIOUS FLOW FIELDS. STAGE 2: CHANNEL
D. P. Hope *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 3 1973 14 p refs (For primary document see N79-22492 13-37)
(GN-13678) Avail: NTIS HC A09/MF A01

An iterative solution to the analysis problem of inviscid, linearized compressible, potential flow through a two dimensional channel is presented. The method of solution is similar to that used in the analysis of Coanda flow - the nonlinear integral equations that represent the surface velocity distributions are solved using an iterative process - but for the sake of completeness the entire theoretical background to the technique is included. Author

N79-22504# Rolls-Royce Ltd., Bristol (England). Turbomachinery Research Dept.
SOLUTION OF THE AERODYNAMIC ANALYSIS PROBLEM FOR VARIOUS FLOW FIELDS. PART 1: COANDA SURFACES
D. P. Hope *In* Von Karman Inst. for Fluid Dyn. Transonic Flows in Turbomachinery, Vol. 3 1973 13 p refs (For primary document see N79-22492 13-37)
(GN-13095) Avail: NTIS HC A09/MF A01

A mathematical solution to the analysis problem for coanda jet flow is developed for two dimensional, nonviscous, irrotational, linearized compressible flow. The nonlinear second order partial differential equation, derived from the equations of continuity and irrotational motion, is reduced to an integral equation, which although nonlinear involves only boundary values of the dependent variable. Numerical solution of this integral equation by the use of an iterative process is proposed. J.M.S.

N79-22505# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SAMPLE CALCULATION 9
R. A. VandenBraembussche *In its* Transonic Flows in Turbomachinery, Vol. 3 1973 6 p (For primary document see N79-22492 13-37)
Avail: NTIS HC A09/MF A01

Calculations are done with a given inlet air angle and given inlet Mach number. However, comparison with experimental results is done on the basis of oult outlet Mach number. The results, plotted in graphs, are obtained by linear interpolation from results for various values of Mach number. Although this method is theoretically limited to subsonic flow, an attempt is made to predict the flow at the higher outlet Mach number, where the flow is locally supersonic. J.M.S.

N79-22506# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ADVANCED RADIAL COMPRESSORS
1974 293 p refs Lecture series held at Rhode-Saint-Genese, Belgium, 25-29 Mar. 1974
(VKI-Lecture-Series-66) Avail: NTIS HC A13/MF A01

Various aspects of the dynamics of unsteady flow in centrifugal compressors are presented. Dynamic models of the centrifugal compressors are described. Applications of the dynamic measurement techniques for unsteady flow including flow visualization methods are discussed. The utilization of this technology development for small aircraft engines is reported. For individual titles, see N79-22507 through N79-22509.

N79-22507# Technische Universitaet, Hanover (West Germany).
ENERGY TRANSFER IN CENTRIFUGAL COMPRESSORS
Karl Bammert, Amin Mobarak, and Manfred Rautenberg *In* Von Karman Inst. for Fluid Dyn. Advanced Radial Compressors 1974 43 p refs (For primary document see N79-22506 13-37)
Avail: NTIS HC A13/MF A01

A theoretical study on the complicated conditions of flow in rotating, energy transferring systems is discussed. The mechanisms in these systems are of a highly unsteady nature, i.e. in the relative system (impeller) the flow conditions existing at a particular point vary with time. It is this characteristics of a relative flow which permits theoretical interpretation of energy classification and energy transport processes in the flow. Satisfactory results of relative flow measurements are obtained with new measuring techniques which cater for high frequency changes. Author

N79-22508# Creare, Inc., Hanover, N.H.
THE FLUID DYNAMIC DESIGN OF ADVANCED CENTRIFUGAL COMPRESSORS
Robert C. Dean, Jr. *In* Von Karman Inst. for Fluid Dyn. Advanced Radial Compressors 1974 99 p refs (For primary document see N79-22506 13-37)
Avail: NTIS HC A05/MF A01

The flow models and aerodynamic design systems developed for the centrifugal compressor are described. Some evidence of the success and failings of this approach is given. Important unresolved fluid dynamic problems now barring access to ultimate centifugal compressor performance are defined. Author

N79-22509# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
APPLICATIONS OF DYNAMIC MEASUREMENT TECHNIQUES FOR UNSTEADY FLOW INVESTIGATIONS IN CENTRIFUGAL COMPRESSORS
Dietrich Eckardt *In* Von Karman Inst. for Fluid Dyn. Advanced Radial Compressors 1974 106 p refs (For primary document see N79-22506 13-37)
Avail: NTIS HC A13/MF A01

The dynamic measurement techniques presented are especially suited for unsteady flow investigations in advanced radial compressors. Systems for instantaneous recordings of wall pressures, total pressures, velocities and directions, and data processing of highly fluctuating signals are treated. Applications of these techniques at a centrifugal compressor test stage, with 400 m/s tip speed and a total pressure ratio PR=3, deal with unsteady flow investigations, mainly in the impeller exit/diffuser entry region, where problems of jet/wake mixing, a loss evaluation of impeller flow, and the onset of stall instabilities are discussed. Author

N79-22510# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SECONDARY FLOWS IN TURBOMACHINES
1975 365 p refs Lecture held at Rhode Saint-Genese, Belgium, 13-17 Jan. 1975
(VKI-Lecture-Series-72) Avail: NTIS HC A16/MF A01

A review is given of the present understanding of secondary flows in turbomachinery and, especially, of end wall flows, including their impact on performance and their inclusion in methods of design and analysis. For individual titles, see N79-22511 through N79-22517.

N79-22511# Salford Univ. (England).
SECONDARY FLOWS
J. H. Horlock *In* Von Karman Inst. for Fluid Dyn. Secondary Flows in Turbomachines 1975 38 p refs (For primary document see N79-22510 13-37)

Avail: NTIS HC A16/MF A01

A simple argument in terms of pressure gradients shows how secondary flows develop in a turbine cascade. As the mainstream is turned, a large pressure difference is developed across the band. A secondary rotation of the flow about the main streamline appears. A more detailed picture is shown where the path traced by an element of vorticity is followed as it moves through a compressor cascade. Since the particles move faster over the upper surface of the aerofoil, the vortex line is stretched, components of this vorticity appear in the wake, and at an angle across the mainstream. The streamwise component of the vorticity in the mainstream is referred to as the secondary vorticity. Vorticity is shed in the wall as the lift varies along the blade and some of the entering vorticity is wrapped round the blade and reappears within the wake. L.S.

N79-22512# AiResearch Mfg. Co., Phoenix, Ariz.
A REVIEW OF CASCADE SECONDARY FLOW EFFECTS
J. W. Salvage *In* Von Karman Inst. for Fluid Dyn. Secondary Flows in Turbomachines 1975 89 p refs (For primary document see N79-22510 13-37)
Avail: NTIS HC A16/MF A01

An approach to the problem of secondary flows is to study flows that are less complex than found in the real machine and to attempt to analyze the behavior of the real machine based on simplified models. One experimental tool that has been used to acquire some results concerning secondary flows and end wall effects in general is the plane cascade. The results of experiments using this tool are discussed, the subject of most of this note. L.S.

N79-22513# Princeton Univ., N. J.
AXIAL COMPRESSOR PERFORMANCE PREDICTION EMPHASIZING THE ROLE OF ANNULUS WALL BOUNDARY LAYERS
George L. Mellor *In* Von Karman Inst. for Fluid Dyn. Secondary Flows in Turbomachines 1975 57 p refs (For primary document see N79-22510 13-37)
Avail: NTIS HC A16/MF A01

Relative to cascade performance, annulus wall boundary layers behavior play a disproportionate role in determining the ultimate efficiency and stage loadings of an axial compressor. These lectures are designed to demonstrate that point and to present a theory of annulus wall boundary layers which does lead to loss and blockage prediction at design and off-design flow and wheel speed. Discussion of the boundary layer theory is preceded by some general design considerations, a cascade flow prediction method and a discussion of mainstream annulus flow prediction. The results of calculations combining these basic elements are presented. L.S.

N79-22514# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
REDUCTION OF SECONDARY LOSSES IN TURBINES
C. Sieverding *In its* Secondary Flows in Turbomachines 1975 47 p refs (For primary document see N79-22510 13-37)
Avail: NTIS HC A16/MF A01

The statement that the relative importance of secondary losses increases with decreasing blade height is rather trivial, but from the comparison of secondary loss correlations it appears to be the only feature which all correlations have in common. In the case of rather long blades, i.e. where the blade heights amount to several times the chord length, it might be sufficient to optimize a turbine stage from the point of view of profile losses only. The secondary losses are accepted as an unavoidable evil and their influence on the stage performance are accounted for in the non-isentropic radial equilibrium calculation of the stage. A threshold is, however, reached when the secondary losses become of the same order magnitude of the profile losses or become even predominant. L.S.

N79-22515# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBINE CASCADE END WALL LOSSES, A REVIEW
J. Chauvin *In its* Secondary Flows in Turbomachines 1975 41 p refs (For primary document see N79-22510 13-37)
Avail: NTIS HC A16/MF A01

An evaluation is made of the turbine end wall losses, due to end wall boundary layers and to the interference between end wall and blade boundary layers. The evaluation is made in the absence of clearance or relative wall motion. The empirical relations used are either entirely experimental or based on an approximate physical knowledge of the phenomenon and its parameters of influence, and involving coefficients derived from experiments. The basic experimental data comes essentially from straight cascade tests, usually performed at optimum pitching, as determined from various correlations, usually in disagreement with each other. Many of the end wall loss correlations are intended for nominal conditions only. All of them provide an additional loss coefficient to be added to the two dimensional or mid-span loss, for non-twisted bladings and usually, for cases corresponding to unit axial velocity ratio. L.S.

N79-22516# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A NOTE ON SOME TURBINE SECONDARY FLOW ASPECTS
J. Chauvin *In its* Secondary Flows in Turbomachines 1975 11 p refs (For primary document see N79-22510 13-37)
Avail: NTIS HC A16/MF A01

A discussion is presented of the order of magnitude of driving forces and physical effects in cascades and turbines. These forces and effects are: leading edge vortex, and cross channel pressure gradients in cascades, radial pressure gradients, and relative motion effects in the case of zero clearance, for nozzles and runner blades, as established from calculations or test results available at VKI. L.S.

N79-22517# Ecole Centrale de Lyon (France).
SECONDARY FLOWS IN AXIAL COMPRESSORS
K. Papailiou *In* Von Karman Inst. for Fluid Dyn. Secondary Flows in Turbomachines 1975 118 p refs (For primary document see N79-22510 13-37)
Avail: NTIS HC A16/MF A01

There exist methods which predict with a certain success the behaviour of the compressor wall shear layers. A discussion is presented of the existing methods in the light of a certain number of experimental results. It is hoped to contribute to a better understanding of the behaviour of the secondary flows as well as to the establishment of the degree of their accuracy and the way to their improvement. A correlation is presented and some comparisons are given of Mellor's theory with available experimental results. This gives an idea of the degree of accuracy of the presently available methods. Some new experimental results are presented and a general discussion of the hypotheses of the theories existing today are done. L.S.

N79-22518*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPERATING CHARACTERISTICS OF A CANTILEVER-MOUNTED RESILIENT-PAD GAS-LUBRICATED THRUST BEARING
Zolton N. Nemeth Washington Apr. 1979 30 p refs
(NASA-TP-1438; E-9815) Avail: NTIS HC A03/MF A01 CSCL 13I

A resilient-pad gas thrust bearing consisting of pads mounted on cantilever beams was tested to determine its operating characteristic. The bearing was run at a thrust load of 74 newtons to a speed of 17000 rpm. The pad film thickness and bearing friction torque were measured and compared with theory. The measured film thickness was less than that predicted by theory. The bearing friction torque was greater than that predicted by theory. Author

N79-22519*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF ANALYSIS AND EXPERIMENT FOR SELF-ACTING SEALS FOR LIQUID-OXYGEN TURBOPUMPS
Gordon P. Allen Apr. 1979 15 p refs
(NASA-TP-1443; E-9806) Avail: NTIS HC A02/MF A01 CSCL 13I

Two LOX turbopump applications were analyzed over ranges of pressure differential and speed. Predictions were compared with test results. A small seal was analyzed up to 141 m/sec and 310 N/sq cm differential and a larger seal up to 147 m/sec

and 448 N/sq cm. Tests confirmed analytical predictions of operation without rubbing contact. The seals evidently operated with mostly liquid in the pads and mostly gas across the dam although the best prediction of trends was based on assuming gas throughout the entire seal. Author

N79-22520 This accession not used.

N79-22521*# Battelle Columbus Labs., Ohio.
EVALUATION OF SSME HIGH PRESSURE LIQUID OXYGEN TURBOPUMP BEARINGS Final Report
K. F. Dufrane and J. W. Kannel 6 Apr. 1979 40 p refs
(Contract NAS8-33221)
(NASA-CR-161208) Avail: NTIS HC A03/MF A01 CSCL 13K

Examination of the bearings produced conclusive evidence that a very high axial load was applied to bearing 8517903 during a significant portion of the service time. The high loads caused serious ball and race wear and surface fatigue pitting. In all likelihood, continued operation of this bearing with the high axial load would have caused increasing deterioration and catastrophic failure. In contrast, bearing 8517900 showed much less deterioration and probably had experienced only the axial loads deliberately applied by the preload spring. Bearing 8517900 represents the best-case operation with the loads controlled to the levels intended in the design. Fatigue life calculations on bearing 8517903 with an axial load of 27,000 N showed the intolerance of the bearing to such load levels. L.S.

N79-22522# Sikorsky Aircraft, Stratford, Conn.
ADVANCED COUPLING DEVELOPMENT PROGRAM Final Report, 15 Jun. 1974 - 30 Oct. 1977
Robert A. Stone Oct. 1978 138 p
(Contract DAAJ02-74-C-0054)
(AD-A064296; SER-510004; USARTL-TR-78-40) Avail: NTIS HC A07/MF A01 CSCL 01/3

This report documents a four-phase effort in the development of an advanced technology coupling. A coupling survey(design and operational requirements definition; conceptual and detail design; fabrication; static testing and dynamic testing) was conducted. Two concepts out of seven developed in the program were chosen for fabrication and testing. One coupling, a composite flexure element design, successfully completed a basic dynamic performance test and demonstrated superior operational capability to a stainless steel counterpart. Author (GRA)

N79-22523# SKF Industries, Inc., King of Prussia, Pa.
USER'S MANUAL FOR STEADY STATE AND TRANSIENT THERMAL ANALYSIS OF A SHAFT-BEARING SYSTEM (SHABERTH) Final Report, Sep. 1977 - Apr. 1978
William J. Crecelius Nov. 1978 174 p
(Contract DAAD05-74-C-0747)
(AD-A064150; AD-E430167; ARBRL-CR-00386) Avail: NTIS HC A08/MF A01 CSCL 09/2

Predicting the performance of helicopter engine and transmission bearings following loss of normal circulating lubrication is an important part of an aircraft vulnerability estimate. The program SHABERTH was developed to provide the means of estimating the mechanical and thermal state of critical components within a shaft-bearing-housing drive system, first in the normal service (steady state) lubricated condition, and second, in the oil-starved (transient) condition. The program is installed on the BRL Univac 1108 system and is used primarily to predict time-to-failure and failure mode after oil starvation; however, it will at the same time predict thermal dams, critical clearances and other significant behavioral features of the system under treatment, for both normal and dry operation. The program is being used for problems concerning domestic developmental aircraft and non-domestic aircraft, for which no physical test data or hardware are available. Author (GRA)

N79-22524# Midwest Research Inst., Kansas City, Mo.
PERFORMANCE OF LUBRICANTS: OILS AND GREASES ON WEAR TESTS, COMPACT MATERIALS IN BALL BEARINGS, AND SPUTTERED COATINGS ON GAS-BEARING COUPONS Final Report, 2 Jan. 1975 - 14 Apr. 1978
Karl R. Mecklenburg Sep. 1978 93 p refs
(Contract F33615-75-C-5116)
(AD-A063987; AFML-TR-78-126) Avail: NTIS HC A05/MF A01 CSCL 11/8

This final report for a 39.5-month contract contains the results of several projects conducted on the program. The first project was a continuation of a long-term repeatability study on the Four-Ball wear testers. The work was done to assure that the two test machines were constant in performance. The data confirm that the machine performance was as constant as could be statistically expected, both from machine to machine and for each machine as a function of time. The second project was to conduct Four-Ball wear tests on various oils and greases to determine the ability of the lubricants to prevent wear at various conditions of speed, load, and temperature. Data from 1,111 tests on 200 lubricating materials are reported. The third and fourth projects were to determine performance lives of various greases on the Pope and Navy spindles. Equipment descriptions and test results are included. The fifth project was grease testing in the Sikorsky rigs. These rigs are described and the test results presented. The sixth project discussed was the long-term testing of lubricant compact materials in ball bearings. GRA

N79-22525# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
OXYGEN AND NITROGEN CONTAMINATION DURING ARC WELDING Technical Report, 1 Aug. 1977 - 31 Jul. 1978
T. W. Eagar Aug. 1978 13 p refs
(Contract N00014-77-C-0569)
(AD-A063857; TR-1) Avail: NTIS HC A02/MF A01 CSCL 13/8

The sources, mechanisms, and expected levels of oxygen and nitrogen contamination during gas tungsten arc, gas metal arc, shielded metal arc, self-shielded metal arc, and submerged arc welding are reviewed. Calculations indicating the importance of decomposition of SiO2 into silicon monoxide and oxygen are presented, indicating that silicon transfer between the slag and metal occurs by a gas-metal rather than a slag-metal reaction mechanism. A model suggesting that arc stabilizing additions to fluxes should provide volatile subspecies upon heating is also discussed. Author (GRA)

N79-22526# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
SUBMERGED ARC WELDING OF TITANIUM Technical Report, 1 Aug. 1977 - 31 Jul. 1978
C. S. Chai, J. J. Gullotti, and T. W. Eagar Sep. 1978 44 p refs
(Contract N00014-77-C-0569)
(AD-A064012; TR-2) Avail: NTIS HC A03/MF A01 CSCL 13/8

The submerged arc welding of titanium using CaF2 fluxes has been studied to determine the sources of nitrogen contamination and the effect of flux purity on arc stability and weld bead shape. It is shown that plasma jet entrainment and atmospheric absorption on the hot base plate ahead of the arc prior to flux melting are the primary sources of nitrogen contamination. The arc stability is strongly dependent upon the CaF2 purity. The

high weld bead contact angle is a result of the metal transfer mode of the consumable titanium electrode. In addition, the effect of CaF2 flux on gas tungsten arc welds has been briefly studied, indicating enhanced weld penetration in the presence of a flux. A critical review of available information on Soviet titanium fluxes is also presented. Author (GRA)

N79-22527# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
HIGH TEMPERATURE GAS TURBINE ENGINE COMPONENT MATERIALS TESTING PROGRAM, TASK 1 Annual Report, 1977
C. T. Sims 15 Mar. 1978 175 p
(Contract EX-76-C-01-1765)
(FE-1765-43) Avail: NTIS HC A08/MF A01

The objective of this program is to provide a data base for performance of gas turbine nozzle and bucket materials in coal-derived liquid (CDL) and low-Btu gas environments at temperatures up to 2200 F. This report covers accomplishments during the year 1977. Activity consists of 'Initial Tests' to define the problems, 'Screening Tests' to evaluate a range of high-temperature materials, and 'Confirmation Tests' to evaluate the best materials and cooling design under realistic conditions. The report gives results of totals of 345 h of testing in simulated industrial-size gas turbine rig testing in CDL, and 210 h in low Btu gas. Various levels of ash and alkali metal content were studied in the CDL test. Results of corrosion, fouling and system performance are given. Similarly, low Btu gas combustion was investigated through the 'Initial' and 'Confirmation' test stages with industrial-size systems being evaluated for performance, corrosion and fouling. The latter test was for 55 h, utilizing an air-cooled nozzle cascade, a gas cleanup system and the GEGAS low-Btu gasifier. ERA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-22528# Research Triangle Inst., Research Triangle Park, N. C. Systems and Measurements Div.
BASIC RESEARCH IN SUPPORT OF CONCURRENT FAULT MONITORING IN MODULAR DIGITAL SYSTEMS Interim Report
J. W. Gault (North Carolina State Univ., Raleigh), P. N. Marinos (Duke Univ.), K. S. Trivedi (Duke Univ.), and D. L. Parnas (North Carolina Univ. at Chapel Hill) Jun. 1978 350 p refs
(Contract N00039-77-C-0363)
(AD-A063799; RTI/1504/00-00-1) Avail: NTIS HC A15/MF A01 CSCL 09/2

The overall objective of this effort is to discover on-line fault detection, isolation and repair techniques and measures of effectiveness which will be ultimately applicable to tactical and strategic modular digital systems. GRA

N79-22529# Syracuse Univ., N. Y.
DESIGN OF RELIABILITY TEST PLANS BASED UPON PRIOR DISTRIBUTION Final Technical Report, Oct. 1977 - Apr. 1978
Amrit L. Goel Nov. 1978 547 p refs
(Contract F30602-75-C-0121)
(AD-A064142; RADC-TR-78-241; Rept-78-12) Avail: NTIS HC A23/MF A01 CSCL 14/4

A simple procedure using tabulated values for the design of reliability acceptance sampling plans is described in this report. The failure distribution is considered to be exponential with parameter theta and the prior distribution of theta is taken to be inverted gamma. This procedure is applicable when accept/reject decisions are to be made regarding a sequence of systems or lots. For specified combinations of producer-consumer risks, the procedure described here can be used for the design of a truncated single sample plan for a system. Other single sample plans can be obtained by using the equivalence relations given in this report. The use of the design tables is illustrated via numerical examples. Author (GRA)

N79-22530# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
SIMULATION OF SEQUENTIAL TESTS
William J. Broem Nov. 1978 54 p
(DA Proj. 1R7-65706-M-541)
(AD-A063875; AMSAA-TR-241) Avail: NTIS HC A04/MF A01 CSCL 12/1

A computer program is presented which simulates a Probability Ratio Sequential Test (PRST) plan from MIL-STD 781C. Upon selection of an applicable test plan and a lower test MTBF (theta 1), the simulation determines, for a chosen range of true MTBFs, the probability of reaching maximum (total) test time before making a decision (to either accept or reject equipment) and the probability of reaching the last failure in the test plan. Examples are available from selected test plans. Author (GRA)

N79-22531# Stanford Univ., Calif. Dept. of Statistics.
A NEW APPROACH TO INFERENCE FROM ACCELERATED LIFE TESTS
Frank Proschan and Nozer D. Singpurwalla 4 Dec. 1978 22 p refs
(Grants DAAG29-77-G-0031; AF-AFOSR-2581-74)
(AD-A063841; SU-TR-26; ARO-14435.26-M) Avail: NTIS HC A02/MF A01 CSCL 14/2

A new approach has been recently proposed for making inferences from accelerated life tests. Their approach is significantly different from those that have been considered in the past, and is motivated by what is actually done in practice. A priori information which is generally available to the engineer is incorporated under their approach by adopting a Bayesian point of view. The usuall assumptions about the failure distributions and the acceleration functions, which are appealing from a statistical point of view, have been sacrificed to achieve greater reality. This paper applies this new approach to some real life data arising from an accelerated life test. In the process, the new approach is explained in a manner which makes it easy to understand and apply by the reliability practitioner. GRA

N79-22532# Florida State Univ., Tallahassee. Dept. of Statistics.
THE EXTREME POINTS OF THE SET OF DECREASING FAILURE RATE DISTRIBUTIONS Interim Report
Naftali A. Langberg, Ramon V. Leon, James Lynch, and Frank Proschan Nov. 1978 20 p refs
(Grant AF-AFOSR-3678-78; AF Proj. 2304)
(AD-A064786; FSU-Statistics-M484; TR-78-5; AFOSR-79-0092TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The extreme points of the convex set of decreasing failure rate (DFR) distributions is identified. Using Choquet's Theorem, it is shown that any DFR distribution can be represented as a mixture of these extreme points. Also presented are some partial results in identifying the extreme points of the convex set of distributions with decreasing failure rate average. Author (GRA)

N79-22533# Army Construction Engineering Research Lab., Champaign, Ill.
PROCEDURES FOR COLLECTION OF RELIABILITY AVAILABILITY, AND MAINTAINABILITY DATA ON ELECTRICAL AND MECHANICAL SYSTEMS
Edward M. Takemori and M. J. Pollock Jan. 1979 60 p refs
(DA Proj. 4A7-63734-DT-08)
(AD-A064657; CERL-SR-E-137) Avail: NTIS HC A04/MF A01 CSCL 05/2

This report presents the results of a study of methods to acquire and store data on the reliability, availability, and maintainability (RAM) of electrical and mechanical systems. Data acquisition methods previously used by the Corps of Engineers were reviewed and new methods and equipment now being developed were evaluated. Forms are proposed to aid in the collection and handling of information in a logical manner. Methods for storing data either manually or by computer are also presented. The results show that new computer systems, together with available communications equipment and the proposed forms,

can be combined to provide an efficient and economical means of acquiring and storing RAM data. Author (GRA)

N79-22534# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE EDDY CURRENT TESTING AND INSPECTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964-1978
William E. Reed Mar. 1979 239 p Supersedes NTIS/PS-78/0059
(NTIS/PS-79/0106/9; NTIS/PS-78/0059) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

The bibliography cites reports from Government-sponsored research covering techniques, equipment, and applications. Applications include crack, flaw, and corrosion detection, fatigue determination, inspection of components, quality control, thickness measurement, and evaluation and characterization of materials. GRA

N79-22535# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE EDDY CURRENT TESTING AND INSPECTION, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975-1978
William E. Reed Mar. 1979 192 p Supersedes NTIS/PS-78/0061
(NTIS/PS-79/0107/7; NTIS/PS-78/0061) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

The bibliography cites reports from worldwide research covering techniques, equipment, and applications. Applications include crack, flaw, and corrosion detection, fatigue determination, inspection of components, quality control, thickness measurement, and evaluation and characterization of materials. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-22536 Missouri Univ. -Rolla.
STRENGTH OF COLD-FORMED STEEL REINFORCED BEAM WEBS IN BENDING, SHEAR, AND WEB CRIPPLING Ph.D. Thesis
Nguyen Phung 1978 247 p
Avail: Univ. Microfilms Order No. 7905181

The structural behavior of cold-formed steel beam webs with transverse and longitudinal stiffeners subjected to bending stress, shear stress, and web crippling load has been investigated experimentally. The stiffener requirements were also studied. Dissert. Abstr.

N79-22537* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FATIGUE FAILURE LOAD INDICATOR Patent
Leland A. Imig, William T. Davis, and David C. Davis, inventors (to NASA) Issued 27 Mar. 1979 4 p Filed 24 Mar. 1978 Supersedes N78-22346 (16-13, p 1701)
(NASA-Case-LAR-12027-1; US-Patent-4,145,933; US-Patent-Appl-SN-889670; US-Patent-Class-73-770; US-Patent-Class-73-810) Avail: US Patent and Trademark Office CSCL 20K

An indicator for recording the load at which a fatigue specimen breaks during the last cycle of a fatigue test is described. A load cell is attached to the specimen which is alternately subjected to tension and compression loads. The output of the load cell which is proportional to the load on the specimen is applied to the input of a peak detector. Each time the specimen is subjected to a compression load, means are provided for applying a positive voltage to the rest of the peak detector to reset it. During the last cycle of the tension load the peak detector measures the maximum load on the specimen. Means are provided for disconnecting the load cell from the peak detector when there is a failure in the specimen. Official Gazette of the U.S. Patent and Trademark Office

N79-22538# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
SEQUENCE EFFECTS IN FATIGUE CRACK GROWTH DESCRIBED ON A CONTINUUM MECHANICS BASIS
H. Fuehring and T. Seeger 1978 21 p refs Presented at the 2d European Colloq. on Fracture (ECF 2), Darmstadt, West Ger., 9-11 Oct. 1978 Submitted for publication
(ICAF-1063) Avail: NTIS HC A02/MF A01

The functional type of a relationship is presented describing single peak overload delay cycles as a function of a sole parameter. The absolute number of delay cycles depends on the constant amplitude crack growth behavior of the material and at least two material constants. A first attempt is made to find the basic scheme behind this class of load sequences. The relationships are derived on the basis of elasto-plastic fatique fracture mechanics solutions including crack closure but with some very simplifying assumptions. G.Y.

N79-22539*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE 13TH AEROSPACE MECHANISMS SYMPOSIUM
Aleck C. Bond 1979 300 p refs Proc. of Symp. held at Houston, Tex., 26-27 Apr. 1979
(NASA-CP-2081; S-496) Avail: NTIS HC A13/MF A01 CSCL 13I

Technological areas covered include propulsion, motion compensation, instrument pointing and adjustment, centrifuge testing, bearing design, vehicle braking, and cargo handling. Devices for satellite, missile, and hypersonic-wind-tunnel applications; space shuttle mechanical and thermal protection systems; and techniques for building large space structures are described. In addition, a fluid drop injector device for a Spacelab experiment, a helical grip for cable cars, and applications of rare earth permanent magnets are discussed. For individual titles, see N79-22540 through N79-22563.

N79-22540*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HYDRAZINE MONOPROPELLANT RECIPROCATING ENGINE DEVELOPMENT
James W. Akkerman *In its* The 13th Aerospace Mech. Symp. 1979 p 1-14 (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 21G

A hydrazine fueled piston engine for providing 11.2 kW was developed to satisfy the need for an efficient power supply in the range from 3.7 to 74.6 kW where existing nonair-breathing power supplies such as fuel cells or turbines are inappropriate. The engine was developed for an aircraft to fly to 21.3 km and above and cruise for extended periods. A remotely piloted aircraft and the associated flight control techniques for this application were designed. The engine is geared down internally (2:1) to accommodate a 1.8 m diameter propeller. An alternator is included to provide electrical power. The pusher-type engine is mounted onto the aft closure of the fuel tank, which also provides mounting for all other propulsion equipment. About 20 hrs of run time demonstrated good efficiency and adequate life. One flight test to 6.1 km was made using the engine with a small fixed-pitch four-bladed propeller. The test was successful in demonstrating operational characteristics and future potential. J.M.S.

N79-22541*# Sikorsky Aircraft, Stratford, Conn.
DESIGN AND DEVELOPMENT OF A MOTION COMPENSATOR FOR THE RSRA MAIN ROTOR CONTROL
P. Jeffrey and R. Huber *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 15-25 refs (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 01C

The RSRA, an experimental helicopter, is equipped with an active isolation system that allows the transmission to move relative to the fuselage. The purpose of the motion compensator is to prevent these motions from introducing unwanted signals to the main rotor control. A motion compensator concept was developed that has six-degree-of-freedom capability. The mechanism was implemented on RSRA and its performance verified by ground and flight tests. J.M.S.

N79-22542*# Appleton Lab., Abingdon (England). Astrophysics Research Div.

A TWO-AXIS POINTING SYSTEM FOR AN ORBITING ASTRONOMICAL INSTRUMENT

R. F. Turner and J. G. Firth *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 27-38 (For primary document see N79-22539 13-39)

Avail: NTIS HC A13/MF A01 CSCL 14B

The system described was built for incorporation into a solar flare X-ray instrument due to be orbited as one of a number of instruments on the NASA Solar Maximum Mission (SMM) satellite in late 1979. It enables the instrument to be rotated about 2 mutually perpendicular axes in 5 arc-second steps within a range of 7 arc-minutes, thus giving the instrument the capability to map areas of the sun. J.M.S.

N79-22543*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

DEVELOPMENT OF THE TRIDENT 1 AERODYNAMIC SAIKE MECHANISM

Mark D. Waterman and B. J. Richter *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 39-48 (For primary document see N79-22539 13-39)

Avail: NTIS HC A13/MF A01 CSCL 16D

The Aerospike drag reduction mechanism was designed and daveloped for use on the Trident I submarine launched ballistic missile. This mechanism encounters a unique combination of environments necessitating unique design solutions to ensure satisfactory operation over its design life. The development of the Aerospike is reviewed emphasizing the unique and interesting problems encountered and their solutions. J.M.S.

N79-22544*# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

A TELESCOPIC JIB FOR CONTINUOUS ADJUSTMENT

C. Ch. Etzler *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 49-58 (For primary document see N79-22539 13-39)

Avail: NTIS HC A13/MF A01 CSCL 13I

For special space applications, e.g. for experiments distant from any orbital platforms or manipulators a new kind of jibs with extreme extension capacity has to be designed. Considering the requirements, the telescopic principle is found to be the most promising. For the choice of the stiff structure, design criteria are evaluated. Special effort deals with the drive system. An electromechanical system can satisfy the requirements. First results of the development of such a drive are presented. The most significant features are: A telescopic assembly of tubes which can be mutually moved by a short spindle in the center of the package. An elastically suspended screw is located at the bottom of each tube. For the jib extension, these screws will be linked with the spindle. The control of their sequence and the adjustment of tubes in mutual end positions are performed by latches. A functional model proved the basic idea. Author

N79-22545*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DESIGN OF A PIEZOELECTRIC SHAKER FOR CENTRIFUGE TESTING

Jeffrey G. Canclini and Jerald M. Henderson (California Univ., Davis) *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 59-70 refs (For primary document see N79-22539 13-39)

Avail: NTIS HC A13/MF A01 CSCL 13I

The design of a prototype piezoelectric shaker and its development to date is described. Although certain design problems remain to be solved, the piezoelectric system shows promise for adaptation to a larger payload system, such as the proposed geotechnical centrifuge at the Ames Research Center. J.A.M.

N79-22546*# Hughes Aircraft Co., Culver City, Calif.

GIMBAL BEARING DESIGN CONSIDERATIONS AND FRICTION CONTROL

Nathan R. Kramer *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 71-81 (For primary document see N79-22539 13-39)

Avail: NTIS HC A13/MF A01 CSCL 13I

The design considerations of bearing selection, bearing fits, bearing installation, and thermal control are discussed for a gimbal with a high stiffness, low friction torque requirement. Tradeoffs between a quad set of small diameter spread apart or a large diameter bearing pair resulted in a cleaner, lighter, stiffer unit with the latter selection. Bearing fits were designed to eliminate clearances with tolerances of .00127 mm 00005 in) on the bearing shafts and housings. The problems in metrology are discussed and a perferred technique for measurement of small cross-section bearings described. A technique for installation to assure proper seating of the bearing is offered. Where transient thermal conditions are involved, a method of controlling bearing friction by active control of bearing temperature gradients including the use of bearing unload test curves is described. J.A.M.

N79-22547*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HELICAL GRIP FOR THE CABLE CARS OF SAN FRANCISCO

Richard J. Peyran *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 83-93 refs (For primary document see N79-22539 13-39)

Avail: NTIS HC A13/MF A01 CSCL 13I

A helical cable car grip to minimize high maintenance costs of San Francisco's cable car operation is presented. The grip establishes a rolling contact between the cable and grip to reduce sliding friction and associated cable wear. The design, development, and testing of the helical cable car grip are described. J.A.M.

N79-22548*# Boeing Commercial Airplane Co., Seattle, Wash.

LOAD PROPORTIONAL SAFETY BRAKE

Michael J. Cacciola *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 95-110 (For primary document see N79-22539 13-39)

Avail: NTIS HC A13/MF A01 CSCL 13I

This brake is a self-energizing mechanical friction brake and is intended for use in a rotary drive system. It incorporates a torque sensor which cuts power to the power unit on any overload condition. The brake is capable of driving against an opposing load or driving, paying-out, an aiding load in either direction of rotation. The brake also acts as a no-back device when torque is applied to the output shaft. The advantages of using this type of device are: (1) low frictional drag when driving; (2) smooth paying-out of an aiding load with no runaway danger; (3) energy absorption proportional to load; (4) no-back activates within a few degrees of output shaft rotation and resets automatically; and (5) built-in overload protection. J.A.M.

N79-22549*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A ZERO G FLUID DROP INJECTOR FOR THE DROP DYNAMICS MODULE SPACELAB EXPERIMENT

George M. Holtz *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 111-126 (For primary document see N79-22539 13-39)

(Contract NAS7-100)

Avail: NTIS HC A13/MF A01 CSCL 14B

A fluid drop injector was developed to form and release fluid drops into free drift within an experimental apparatus known as the Drop Dynamics Module which is to be flown on an earth orbiting Spacelab. To verify the design concept, a breadboard injector was flown on the NASA KC-135 zero g airplane after which more extensive laboratory 1 g tests were performed to improve the injector design and enable it to meet the module's functional requirements. The breadboard fluid drop injector will be modified and upgraded to flight hardware. Author

N79-22550*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

ON THE DESIGN OF AN ADJUSTABLE HIGH PRECISION LATCHING HINGE

John W. Ribble and William D. Wade *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p p 127-136 (For primary document see N79-22539 13-39)

Avail: NTIS HC A13/MF A01 CSCL 13E

The design and test details of a high precision hinge and locking mechanism created principally in support of the Lockheed space deployable Flexrib Parabolic Antenna concept are presented.

These developed improvements in the detail design of ultra-precise rib hinge and contour adjustment mechanisms will allow radio frequency antenna reflectors to expand into the 15-50 meter diameter size class and to support the .013 mm. deployment repeatability tolerance required to support the 12+ GHz frequency range. Author

N79-22551*# Hughes Aircraft Co., Culver City, Calif.
RELIABILITY BREAKTHROUGH: AN ANTENNA DEPLOYMENT/POSITIONING MECHANISM WITH ELECTRICAL AND MECHANICAL REDUNDANCY
M. C. Olson, L. W. Briggs, and J. B. Pentecost *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 137-149 (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 13I

An Antenna Positioner Mechanism (APM) was developed for deployment of an antenna reflector and for fine granularity closed loop tracking of the antenna in response to RF beacon error signals. By utilizing permanent magnet stepper motors, spur gearheads, irreversible single threat worm/wheel assemblies and a miter gear differential, full electrical and mechanical redundancy was realized. Two versions of this design were generated: one is a weight-optimized design with a clutch for overload protection and one is a more rugged unit without a clutch. Author

N79-22552*# General Electric Co., Philadelphia, Pa.
DEVELOPMENT OF DRIVE MECHANISMS FOR COMMUNICATON SATELLITES
Arnold C. Schneider and Thomas D. McLay *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 151-166 (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 22B

A distinguished pedigree is an important asset in the development of Aerospace mechanisms. Four drives recently developed for communication satellites are outgrowths of a previously-proven drive configuration. Pedigree by itself, however is not enough to generate success. Inevitably, design changes which are thought to be minor, are generally introduced to fine tune the pedigreed hardware to meet particular requirements of a specific new application. Such design changes are often viewed too casually and are not thoroughly tested in the early development stages of the program. Two areas of design change are described on the solar array drive applied to the Japanese Broadcast Satellite which led to subsequent problems during the development phase of the program. The methods applied to establish the cause and the solution of these problems are described as well as the testing approach adapted to prevent similar occurrences on the current Communication Satellite Program, The Defense System Communications Satellite III. L.S.

N79-22553*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TESTS OF A PROTECTIVE SHELL PASSIVE RELEASE MECHANISM FOR HYPERSONIC WIND-TUNNEL MODELS
Richard L. Puster and James E. Dunn (Prototype Development Associates, Santa Ana, Calif.) *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 167-181 refs (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 13I

A protective shell mechanism for wind tunnel models was developed and tested. The mechanism is passive in operation, reliable, and imposes no new structural design changes for wind tunnel models. Methods of predicting the release time and the measured loads associated with the release of the shell are given. The mechanism was tested in a series of wind tunnel tests to validate the removal process and measure the pressure loads on the model. The protective shell can be used for wind tunnel models that require a step input of heating and loading such as a thin skin heat transfer model. The mechanism may have other potential applications. Author

N79-22554*# Centre National d'Etudes Spatiales, Paris (France).
MAGNETIC SPRING IN OSCILLATING MIRROR LINEAR SCANNER FOR SATELLITE CAMERA
G. Thomin and C. Fouche (Societe Europeene de Propulsion) *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 183-193 (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 13I

One of the main difficulties encountered in the development of a multispectral scanner is the realization of an oscillating mechanical device. A magnetic device which is characterized by the absence of friction is presented. The main developments concern the analysis of magnetic forces. A preliminary project of a device which could be used in a satellite is presented. G.Y.

N79-22555*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE IMPACT OF RARE EARTH COBALT PERMANENT MAGNETS ON ELECTROMECHANICAL DEVICE DESIGN
R. L. Fisher and P. A. Studer *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 195-206 refs (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 09A

Specific motor designs which employ rare earth cobalt magnets are discussed with special emphasis on their unique properties and magnetic field geometry. In addition to performance improvements and power savings, high reliability devices are attainable. Both the mechanism and systems engineering should be aware of the new performance levels which are currently becoming available as a result of the rare earth cobalt magnets. G.Y.

N79-22556*# Martin Marietta Aerospace, Orlando, Fla.
UNFOLDING THE AIR VANES ON A SUPERSONIC AIR-LAUNCHED MISSILE
Martin Wohltmann and Michael D. OLeary *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 207-217 (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 16D

ASALM (Advanced Strategic Air-Launched Missile) is a supersonic air vehicle designed to be air-launched from a carrier aircraft. The four aft aerodynamic control vanes are folded to maximize the number of missiles carried on-board. The unfolding (erection) system must be small, energetic, fast, and strong. The materials selected and problems that arose during development of the unfolding system are described. G.Y.

N79-22557*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMARY OF THE ORBITER MECHANICAL SYSTEMS
John Kiker and Kirby Hinson *In its* The 13th Aerospace Mech. Symp. 1979 p 219-234 ref (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 22B

Major mechanical systems of the Orbiter space vehicle are summarized with respect to general design details, manner of operation, expected performance, and, where applicable, unique features. A synopsis of data obtained during the five atmospheric flight tests of spacecraft OV-101 and status of the systems for the first orbital spacecraft STS-1 are presented. Author

N79-22558*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PAYLOAD INSTALLATION AND DEPLOYMENT AID FOR SPACE SHUTTLE ORBITER SPACECRAFT REMOTE MANIPULATOR SYSTEM
Thomas O. Ross *In its* The 13th Aerospace Mech. Symp. 1979 p 235-249 (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 22B

An aid concept known as the PIDA (Payload Installation and Deployment Aid) is presented as a way to assist the RMS (Remote Manipulator System) by relaxing the accuracy required during payload handling in the payload bay. The aid concept was designed and developed to move payloads through a prescribed path between the confined quarters of the payload bay and a position outside the critical maneuvering area of the Orbiter. A description of the design requirements and the modes of operation of the various functions of the deployment and the docking mechanisms are covered. G.Y.

N79-22559*# Rockwell International Corp., Downey, Calif. Space Systems Group.
SPACE SHUTTLE ORBITER AFT HEAT SHIELD SEAL
L. J. Walkover *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 251-259 (For primary document

see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 22B

The evolution of the orbiter aft heat shield seal (AHSS) design, which involved advancing mechanical seal technology in severe thermal environment is discussed. The baseline design, various improvements for engine access, and technical problem solution are presented. It is a structure and mechanism at the three main propulsion system (MPS) engine interfaces to the aft compartment structure. Access to each MPS engine requires disassembly and removal of the AHSS. Each AHSS accommodates the engine movement, is exposed to an extremely high temperature environment, and is part of the venting control of the aft compartment. S.E.S.

N79-22560*# Rockwell International Corp., Downey, Calif. Space Systems Group.
SPACE SHUTTLE ORBITER PAYLOAD BAY DOOR MECHANISMS
Bill M. McAnally *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 261-269 (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01

The opening, closing, and latching of the first large clamshell door to operate in space presented some unusual challenges for the mechanism designer of the Space Shuttle Program. The requirements, hardware configuration, design trade-offs, and qualification testing in process to meet the challenge and to make the system operational for the Shuttle orbiter's approaching first orbital flight are described. S.E.S.

N79-22561*# United Technologies Corp., East Hartford, Conn. Chemical Systems Div.
IUSTHRUST VECTOR CONTROL (TVC) SERVO SYSTEM
G. E. Conner *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 271-281 (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 21H

The IUS TVC SERVO SYSTEM which consists of four electrically redundant electromechanical actuators, four potentiometer assemblies, and two controllers to provide movable nozzle control on both IUS solid rocket motors is developed. An overview of the more severe IUS TVC servo system design requirements, the system and component designs, and test data acquired on a preliminary development unit is presented. Attention is focused on the unique methods of sensing movable nozzle position and providing for redundant position locks. S.E.S.

N79-22562*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AUTOMATIC IN-ORBIT ASSEMBLY OF LARGE SPACE STRUCTURES
Georges G. Jacquemin *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 283-291 refs (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 22A

The automated assembly of a large number of components required for the on-orbit erection of large tetrahedral space platforms is described. The assembly machine is a huge jig in which a multitude of mechanisms must operated continuously in the thermo vacuum environment of space and under the control of computers programmed to command every step of each motion. The concepts are presented to determine the most reliable solution. Continuous operation of mechanisms in space presents many unresolved problems, with regard to lubrication of unprotected devices, such as chain drives, which must maintain reasonable positioning tolerances. S.E.S.

N79-22563*# General Dynamics/Convair, San Diego, Calif.
DEVELOPMENT OF A BEAM BUILDER FOR AUTOMATIC FABRICATION OF LARGE COMPOSITE SPACE STRUCTURES
John G. Bodle *In* NASA. Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 293-304 ref (For primary document see N79-22539 13-39)
Avail: NTIS HC A13/MF A01 CSCL 22B

The composite material beam builder which will produce triangular beams from pre-consolidated graphite/glass/thermoplastic composite material through automated mechanical processes is presented, side member storage, feed and positioning, ultrasonic welding, and beam cutoff are formed. Each process lends itself to modular subsystem development. Initial development is concentrated on the key processes for roll forming and ultrasonic welding composite thermoplastic materials. The construction and test of an experimental roll forming machine and ultrasonic welding process control techniques are described. S.E.S.

N79-22564*# Iowa Univ., Iowa City. Div. of Materials Engineering.
ENDOCHRONIC THEORY OF TRANSIENT CREEP AND CREEP RECOVERY
Han-Chin Wu and Lee Chen 20 Apr. 1979 47 p refs (Grant NsG-1499)
(NASA-CR-158487; G-302-79-001) Avail: NTIS HC A03/MF A01 CSCL 20K

Short time creep and creep recovery were investigated by means of the endochronic theory of viscoplasticity. It is shown that the constitutive equations for constant-strain-rate stress-strain behavior, creep, creep recovery, and stress relaxation can all ber derived from the general constitutive equation by imposing appropriate constraints. In this unified approach, the effect of strain-hardening is naturally accounted for when describing creep and creep recovery. The theory predicts with reasonable accuracy the creep and creep recovery behaviors for Aluminum 1100-0 at 150 C. It was found that the strain-rate history at prestraining stage affects the subsequent creep. A critical stress was also established for creep recovery. The theory predicts a forward creep for creep recovery stress greater than the critical stress. For creep recovery stress less than the critical stress, the theory then predicts a normal strain recovery. G.Y.

N79-22565*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF GRAIN ORIENTATION AND COATING ON THERMAL FATIGUE RESISTANCE OF A DIRECTIONALLY SOLIDIFIED SUPERALLOY (MAR-M 247)
P. T. Bizon, R. L. Dreshfield, and F. D. Calfo Apr. 1979 24 p refs
(NASA-TM-79129; E-9968) Avail: NTIS HC A02/MF A01 CSCL 20K

The effect of off-axis directionally solidified (DS) grain growth on thermal fatigue life of Mar-M 247 alloy was evaluated. Uncoated conventionally cast as well as DS wedge bars were cycled in a burner rig between 1070 C and room temperature. The longitudinal axis and leading edge of the specimen coincided. As the angle between the specimen longitudinal axis and growth axis increased, the thermal fatigue life decreased for both the uncoated and aluminide-coated bars. Life increases of about 50 cycles for the DS conditions were attributed to coating. The decrease in thermal fatigue life with increasing angle is primarily attributed to the increase in modulus of elasticity with increasing angle and not to the intersection of DS grain boundaries with the specimen leading edge. The thermal fatigue cracks were observed to be transgranular in the DS material. Limited tensile and stress-rupture properties of conventionally cast and off-axis DS Mar-M 247 alloy are also presented. L.S.

N79-22566*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RECENT DEVELOPMENT IN THE DESIGN, TESTING AND IMPACT-DAMAGE TOLERANCE OF STIFFENED COMPOSITE PANELS
Jerry G. Williams, Melvin S. Anderson, Marvin D. Rhodes, James H. Starnes, Jr., and W. Jefferson Stroud Apr. 1979 34 p refs Presented at the 4th Conf. on Fibrous Composites in Structural Design, San Diego, Cal., Nov. 1978
(NASA-TM-80077) Avail: NTIS HC A03/MF A01 CSCL 20K

Structural technology of laminated filamentary-composite stiffened-panel structures under combined inplane and lateral loadings is discussed. Attention is focused on: (1) methods for analyzing the behavior of these structures under load and for determining appropriate structural proportions for weight-efficient configurations; and (2) effects of impact damage and geometric imperfections on structural performance. Recent improvements in buckling analysis involving combined inplane compression and shear loadings and transverse shear deformations are presented. A computer code is described for proportioning or sizing laminate

layers and cross-sectional dimensions, and the code is used to develop structural efficiency data for a variety of configurations, loading conditions, and constraint conditions. Experimental data on buckling of panels under inplane compression is presented. Mechanisms of impact damage initiation and propagation are described. Author

N79-22567# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

ANALYZING SLIDING STABILITY OF STRUCTURES USING THE COMPUTER PROGRAM GWALL Final Report

Robert L. Hall Dec. 1978 36 p refs

(AD-A064201; WES-Instruction-K-78-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report documents the usage of the computer program GWALL to analyze the sliding stability of structures. The program provides for display of input data for easy checking and editing and requires the use of a Tektronix 4014 or other terminals with same capabilities. The analysis is a wedge method slope-stability analysis that follows the design procedures used in the Lower Mississippi Valley Division for analysis of plane failures. The program provides for calculation of uplift by entering profile of force water seepage pressures. Author (GRA)

N79-22568# Oakland Univ., Rochester, Mich. School of Engineering.

OPTIMUM HOLESHAPES IN FINITE PLATES UNDER UNIAXIAL LOAD

A. J. Durelli and K. Rajaiah Feb. 1979 38 p refs

(Contract N00014-76-C-0487; Grant NSF ENG-77-07974)

(AD-A064616) Avail: NTIS HC A03/MF A01 CSCL 20/11

This paper presents optimized hole shapes in plates of finite width subjected to uniaxial load for a large range of hole to plate widths (D/W) ratios. The stress concentration factor for the optimized holes decreased by as much as 44% when compared to circular holes. Simultaneously, the area covered by the optimized hole increased by as much as 26% compared to the circular hole. Coefficients of efficiency between 0.91 and 0.96 are achieved. The geometries of the optimized holes for the D/W ratios considered are presented in a form suitable for use by designers. It is also suggested that the developed geometries may be applicable to cases of rectangular holes and to the tip of a crack. This information may be of interest in fracture mechanics. Author (GRA)

N79-22569# Washington Univ., Seattle. Dept. of Mechanical Engineering.

A CRITICAL EXAMINATION OF A NUMERICAL FRACTURE DYNAMIC CODE

L. Hodulak, A. S. Kobayshi, and A. F. Emery Feb. 1979 30 p refs

(Contract N00014-76-C-0060)

(AD-A065093; TR-34) Avail: NTIS HC A03/MF A01 CSCL 20/11

After upgrading the energy dissipation algorithm, numerical experiments were conducted to assess the reliability of the explicit dynamic finite element code, HCRACK. Two dynamic fracture specimens, i.e., the wedge-loaded rectangular DCB (RDCB) specimen and the wedge-loaded tapered DCB (TDCB) specimen, were then analyzed with this updated fracture dynamic code. Using the experimentally determined dynamic fracture toughness, K sub ID, versus crack velocity, a-dot, relation, the RDCB specimen was analyzed first by the 'propagation method' where good agreements between calculated and measured K sub ID versus a relation were observed. The calculated a versus time, t, relation was then used as input data in the 'generation method' where the resultant K sub ID were virtually identical to those obtained in the propagation method. Error analyses of the generation method were also made first by using the experimentally determined a versus t relation and secondly by artifically perturbing this relation. A TDCB specimen was then analyzed with both the propagation and generation methods by using the K sub ID versus a-dot relation established for this specimen and the measured a versus t relation, respectively. The computed K sub ID obtained by both methods were good agreement with the experimental results, showing that either approach can be used in analyzing fracture. GRA

N79-22570# Wisconsin Univ. - Madison. Mathematics Research Center.

COMPLIMENTARY ENERGY AND CATASTROPHES

M. J. Sewel Oct. 1978 18 p refs

(Contract DAAG29-75-C-0024)

(AD-A064034; MRC-TSR-1884) Avail: NTIS HC A02/MF A01 CSCL 12/1

The connection between complementary energy and catastrophes is indicated by a simple example, and by referring to work which shows how Legendre transformations can be continued through their singularities where the Hessian is zero. An experiment is described giving a mapping of the plane onto the plane whose stable singularities appear to be folds and angles, rather than folds and cusps. The work is directed towards the general problem of how integrands in dual variational principles can pass through their singularities. GRA

N79-22571# Army Materials and Mechanics Research Center, Watertown, Mass.

SMALL-SCALE YIELDING CALCULATION OF TRANSITION TEMPERATURE AND TOUGHNESS Final Report

Reinier Beeuwkes, Jr. Aug. 1978 41 p

(AD-A063764; AMMRC-TR-78-36) Avail: NTIS HC A03/MF A01 CSCL 20/11

Toughness and a toughness transition temperature for a crack-like notch are calculated for small-scale yielding corresponding to K sub Ic test conditions using a macroscopic material failure representation. This transition is the point about which the failure position changes from the notch tip to a subsurface position or vice versa. In lieu of an exact solution for stresses, three cases are treated to provide reasonable bounds. Case II appears to be quantitatively exact at sufficient distances from the crack tip. Case I. Stresses are from usual elasticity theory. Case II. Stresses are from usual elasticity theory, but strains are from a two-straightline stress-strain relationship and deformations and boundary movement may be large. Case III. Strains are from usual elasticity theory on the argument that even in the yielded region they are substantially contained within a fairly rigid elastic mass. The transition is found to be independent of the tip radius. Because of its simiplicity and consequent clarity, Case I is most extensively discussed. However, if the work-hardening rate of the notch material is very low, Case II must be employed. Author (GRA)

N79-22572# Weidlinger Associates, New York.

DYNAMIC ELASTO-PLASTIC RESPONSE OF SHELLS IN AN ACOUSTIC MEDIUM THEORETICAL DEVELOPMENT FOR THE EPSA CODE

R. Atkatsh, M. P. Bieniek, and M. L. Baron Jul. 1978 80 p refs

(Contract N00014-72-C-0119; N00014-78-C-0820)

(AD-A064102; TR-24) Avail: NTIS HC A05/MF A01 CSCL 20/11

The EPSA (Elastic-Plastic Shell Analysis) code has been developed for the analysis of shells in an acoustic medium subjected to dynamic loadings which produce large elasto-plastic deformations in the shell. The analysis includes the modeling of significant internal structures, which produce hard spots on the shell. In addition, the effects of ambient pressure are considered. This report presents the theoretical development for the EPSA code and a description of the code itself. A users manual for EPSA is planned for the future. The structural equations of motion are derived from the principle of virtual work and descretized over the shell in a manner typical of finite element procedures. The integration in time of the equations of motion are done explicitly via a central difference scheme. The nonlinear Donnell-Vlasov kinematic equations of shell theory are used. Plate strain-displacement relations are established by a two dimensional finite difference scheme. GRA

N79-22573# Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.

FATIGUE CRACK PROPAGATION OF METASTABLE BETA TITANIUM-VANADIUM ALLOYS

Saghana B. Chakrabortty and Edgar A. Starke, Jr. 7 Dec. 1978 37 p refs

(Contract N00014-75-C-0349)

(AD-A064319; GIT-TR-78-3) Avail: NTIS HC A03/MF A01

CSCL 11/6

The fatigue crack propagation behavior of three titanium-vanadium alloys (24, 28 and 32 wt.% V) which have (tensile) deformation modes ranging from coarse twinning to wavy and planar slip has been measured in laboratory air and correlated with their low cycle fatigue properties and microstructure. The fatigue crack growth rate of alloys with similar microstructures but different deformation modes, and of alloys with similar deformation modes but different microstructures have been compared. Increasing the deformation barrier means free path and improving low cycle fatigue properties has been observed to reduce the fatigue crack growth rate at low and intermediate Delta K levels. The fatigue crack growth data have been compared with that calculated from equations which use microstructure and low cycle fatigue parameters. The predictive capability of these equations which contain only measurable parameters has been found to be quite adequate. Author (GRA)

N79-22574# Bristol Univ. (England). H. H. Wills Physics Lab.

STATES OF STRESS AND STRAIN IN ADHESIVE JOINTS Interim Report, 30 Sep. 1977 - 28 Sep. 1978

N. R. Farrar and K. H. G. Ashbee 29 Sep. 1978 45 p refs (Grant AF-AFOSR-3448-77; AF Proj. 2307)
(AD-A064742; AFOSR-79-0066TR) Avail: NTIS HC A03/MF A01 CSCL 13/5

The swelling during water uptake by adhesive joints is strongly inhomogeneous. In particular, there exists a well defined shoulder between fully saturated and less than fully saturated adhesive. The principal stresses, introduced as a consequence of the mechanical constraint exerted by the adherends, include a normal stress that is compressive near the rim of the adhesive layer and tensile near its center. The magnitude of this stress has been measured, for joints involving aluminum as one adherend and a microscope cover slip as the other adherend by analyzing the pattern of Newton's rings created between the cover slip and an optical flat. GRA

N79-22575# Army Natick Research and Development Command, Mass.

PRESSURE STABILIZED BEAM FINITE ELEMENT

Earl C. Steeves Dec. 1978 60 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A064732; NATICK/TR-79/002) Avail: NTIS HC A04/MF A01 CSCL 13/13

The development of a finite element for a pressure stabilized beam is presented and its adaptation to a computer code for the nonlinear structural analysis of frame-supported tents is described. The finite element is based on theory developed in earlier work and includes transverse shear and differential stiffness effects. Third order polynomials are used to represent the transverse displacements and bending rotations. First order polynomials are used to represent the axial and torsional deformation. A condensation is carried out to reduce the number of generalized coordinates to twelve. Two check cases are presented to establish the accuracy of the finite element. Author (GRA)

N79-22576# New Jersey Inst. of Technology, Newark.

DESIGN OF STIFFENED SHELLS Final Report

Arnold Allentuch 1 Feb. 1979 19 p refs
(Contracts N00014-71-A-0124-002; N00014-67-A-0225-001)
(AD-A064836) Avail: NTIS HC A02/MF A01 CSCL 20/11

The objectives of Contract entitled Design of Stiffened Shells, have been (1) to take existing solutions to stiffened shell problems and develop fully documented digital computer programs, (2) to develop optimal designs of submersible structures and develop fully documented digital computer programs, and (3) to develop new solutions to stiffened shell problems where such solutions do not exist and develop fully documented computer programs. These analyses and digital computer programs have all been reported in detail in nine successive New Jersey Institute of Technology (formerly Newark College of Engineering) reports and in a succession of papers published in various professional journals. Author (GRA)

N79-22577# Oakland Univ., Rochester, Mich. School of Engineering.

QUASI-SQUARE HOLE WITH OPTIMUM SHAPE IN AN INFINITE PLATE SUBJECTED TO IN-PLANE LOADING

A. J. Durelli and K. Rajaiah Jan. 1979 35 p refs
(Contract N00014-76-C-0487; Grant NSF ENG-77-07974)
(AD-A064615; Rept-49) Avail: NTIS HC A03/MF A01 CSCL 20/11

This paper deals with the optimization of the shape of the corners and sides of a square hole, located in a large plate and subjected to in-plane loads, with the object of minimizing stress concentrations. Appreciable disagreement has been found between the results obtained previously by other investigators. In this paper new tests have been conducted and discrepancies have been corrected. Using an optimization technique, the authors have developed a quasi square shape which introduces a stress concentration of only 2.54 in a uniaxial field, the comparable value for the circular hole being 3. The efficiency factor of the proposed optimum shape is 0.90 whereas the efficiency factor of the best shape developed previously was 0.71. The shape also is developed that minimizes the stress concentration in the case of biaxial loading when the ratio of biaxiality is 1:-1. Author (GRA)

N79-22578# Naval Research Lab., Washington, D. C.

APPLICATION OF FRACTURE MECHANICS TECHNIQUES TO HIGH TEMPERATURE

K. Sadananda and P. Shahinian Sep. 1978 19 p refs
(AD-A064827) Avail: NTIS HC A02/MF A01 CSCL 11/6

There was a large impetus in recent years to extend fracture mechanics concepts to characterize high temperature crack growth. Several years ago McEvily and Wells(1) reviewed the application of these concepts to safe design in the creep range. Since then, a large body of information on high temperature crack growth in a variety of structural alloys was accumulated and there is a better understanding of the factors that affect crack growth and the limitations these factors impose on the characterization of crack growth by fracture mechanics concepts. Based on the available information we shall attempt to summarize here the applicability of fracture mechanics techniques to high temperature crack growth under cyclic, static, and combined loads and emphasize the conditions that could limit their applicability. Author (GRA)

N79-22579# Army Military Personnel Center, Alexandria, Va.

PARAMETRICALLY EXCITED NONLINEAR MULTI-DEGREE-OF-FREEDOM SYSTEMS Ph.D. Thesis - Virginia Polytech. Inst. and State Univ., Blacksburg. Final Report

Edward G. Tekak Mar. 1979 169 p refs
(AD-A065175) Avail: NTIS HC A08/MF A01 CSCL 20/11

An analysis of parametrically excited nonlinear multi-degree-of-freedom systems is presented. The nonlinearity considered is cubic and small so that the system of equations is weakly nonlinear. Modal damping is included and the parametric excitation is harmonic. The systems examined include those with distinct natural frequencies as well as those with a single repeated frequency. The significant role played by the existence of an internal resonance is explored in depth. The derivative-expansion version of the method of multiple scales, a perturbation technique, is used to develop solvability conditions for the various combinations of internal and parametric resonances considered. Regions where trivial and nontrivial solutions exist are defined and the stability of the solutions within each region is discussed. Nontrivial, unstable solutions have been shown to exist in regions where nontrivial stable solutions are known. Numerical solutions do not hint at the existence of these solutions. The role of internal resonance in parametrically excited systems is explored. Strong modal interaction is demonstrated as a consequence of the presence of the cubic nonlinearity and the internal resonance. Because of this modal coupling, modes other than the one excited can dominate the response. A multiplicity of jumps is shown to exist. GRA

42 GEOSCIENCES (GENERAL)

N79-22580*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A COUPLED RADIATIVE-CONVECTIVE-PHOTOCHEMICAL MODEL OF THE STRATOSPHERE
Robert E. Boughner and John E. Nealy Apr. 1979 48 p refs (NASA-TP-1418; L-12659) Avail: NTIS HC A03/MF A01 CSCL 04A

A one-dimensional atmospheric model is described. The neutral photochemical processes of the troposphere and stratosphere are presented by a reaction set of 87 kinetic processes and 28 photolytic reactions, with vertical transport being taken into account by an eddy diffusion parameter. The vertical temperature profiles are coupled with the chemical calculations by means of a radiative-convective code. The model has the capability of including effects of multiple scattering and diurnal variations in species concentrations. The numerical solution methodology is described in detail, and current input data are given along with results obtained in a sample calculation.Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N79-22581 Ohio State Univ., Columbus.
SOME PHOTOGRAMMETRIC INVESTIGATIONS OF SCANNING AND TRANSMISSION ELECTRON MICROGRAPHY AND THEIR APPLICATIONS Ph.D. Thesis
Mohamed Shawki Elghazali 1978 231 p
Avail: Univ. Microfilms Order No. 7908140

The procedure and the experiment set up used in this research could be adopted for any Electron Microscope. A mathematical model based on the principles of parallel projection that relates the points of the control field to their corresponding images on the micrographs was used. The mathematical model includes twenty parameters that account for the rotations and translations of the specimen holder as well as scale, radial and spiral distortions inherent to the electron micrographs. For the particular Scanning Electron Microscope investigated, it was found that the system is statistically stable at a significance level alpha = 0.02. Dissert. Abstr.

N79-22582* New Mexico Univ., Albuquerque. Technology Application Center.
LITERATURE REVIEW OF THE REMOTE SENSING OF NATURAL RESOURCES Quarterly Literature Review, Oct. - Dec. 1978
Jan. 1979 308 p Sponsored by NASA
(NASA-CR-157961; TAC-RS-78-004) Avail: NTIS HC A14 for foreign requestors only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 05B

A bibliography is presented concerning remote sensing techniques. Abstracts of recent periodicals are included along with author, and keyword indexes. M.M.M.

N79-22583*# Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering
IMPROVED PRECISION IN AERIAL APPLICATION EQUIPMENT Quarterly Progress Report, 1 Jan. - 31 Mar. 1979
Lawrence O. Roth, Principal Investigator 31 Mar. 1979 3 p ERTS
(Grant NsG-6018)
(E79-10184; NASA-CR-158414) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-22584*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
SHORELINE AS A CONTROLLING FACTOR IN COMMERCIAL SHRIMP PRODUCTION
Kenneth H. Faller, Principal Investigator Feb. 1979 33 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10185; NASA-TM-72732) Avail: NTIS HC A03/MF A01 CSCL 08A

The author has indentified the following significant results. An ecological model was developed that relates marsh detritus export and shrimp production. It was based on the hypothesis that the shoreline is a controlling factor in the production of shrimp through regulation of detritus export from the marsh. LANDSAT data were used to develop measurement of shoreline length and areas of marsh having more than 5.0 kilometers of shoreline per square kilometer of area for the Louisiana coast, demonstrating the capability of remote sensing to provide important geographic information. These factors were combined with published tidal ranges and salinities to develop a mathematical model that predicted shrimp production for nine geographic units of the Louisiana coast, as indicated by the long term average commercial shrimp yield.

N79-22585*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Progress Report, Jan. - Mar. 1979
James C. Barnes, Principal Investigator 3 Apr. 1979 5 p Sponsored by NASA ERTS
(E79-10186; NASA-CR-158415) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N79-22586*# Ohio Dept. of Economic and Community Development, Columbus.
DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO. VOLUME 1: EXECUTIVE SUMMARY Final Report
Paul E. Baldridge, Charles Weber, Gary Schaal (Ohio Dept. of Natural Resources), Carl Wilhelm (EPA), G. E. Wurelic (Battelle Columbus Labs.), J. G. Stephan (Battelle Columbus Labs.), T. F. Ebbert (Battelle Columbus Labs.), H. E. Smail (Battelle Columbus Labs.), J. McKeon (Ben Dix Aerospace Systems Div.), and N. Schmidt, Principal Investigators (Bendix Aerospace Systems Div.) 5 Feb. 1977 430 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS2-2399)
(E79-10187; NASA-CR-158447) Avail: NTIS HC A19/MF A01 CSCL 05B

The author has identified the following significant results. A current uniform land inventory was derived, in part, from LANDSAT data. The State has the ability to convert processed land information from LANDSAT to Ohio Capability Analysis Program (OCAP). The OCAP is a computer information and mapping system comprised of various programs used to digitally store, analyze, and display land capability information. More accurate processing of LANDSAT data could lead to reasonably accurate, useful land allocations models. It was feasible to use LANDSAT data to investigate minerals, pollution, land use, and resource inventory.

N79-22587*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Jan. - Mar. 1979
Donald G. Moore, Principal Investigator and J. Heilman Mar. 1979 3 p refs ERTS
(Contract NAS5-24206)
(E79-10188; NASA-CR-158448; SDSU-RSI-79-06) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N79-22588*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Report, 1 Jun. - 30 Nov. 1978
R. A. Weismiller and R. P. Mroczynski, Principal Investigators

30 Nov. 1978 76 p ERTS
(Grant NGL-15-005-186)
(E79-10189; NASA-CR-158449; LARS-CR-042179) Avail: NTIS HC A05/MF A01 CSCL 05A

The author has identified the following significant results. Twenty-eight quarter sections were mapped, representing a total area of 4480 acres or approximately 1.25% of the county. Soil series were not consistently separated on a countywide basis. When internal drainage and parent materials were ascertained, a soil series could be predicted. Each soil spectral class represented one predominant drainage class with minor inclusions of other drainage classes. The same is true with conventional field mapping units that also contain minor inclusions of other drainage classes. Most wetlands could be identified in the LANDSAT classification. There appeared to be some confusion in distinguishing between different wetland types and between some wetland and upland cover types.

N79-22589*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPARISON OF MEASURED AND CALCULATED UPWELLING RADIANCE OVER WATER AS A FUNCTION OF SENSOR ALTITUDE
Thom A. Coney and Jack A. Salzman 1979 19 p refs Presented at the 13th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 23-27 Apr. 1979; sponsored by Mich. Univ.
(NASA-TM-79147; E-003) Avail: NTIS HC A02/MF A01 CSCL 08H

A comparison is made between remote sensing data measured over water at altitudes ranging from 30 m to 15.2 km and data calculated for corresponding altitudes using surface measurements and an atmospheric radiative transfer model. Data were acquired on June 22, 1978 in Lake Erie, a cloudless, calm, near haze free day. Suspended solids and chlorophyll concentrations were 0.59 + or - 0.02 mg/1 and 2.42 + or - 0.03 micrograms/1 respectively throughout the duration of the experiment. Remote sensor data were acquired by two multispectral scanners each having 10 bands between 410 nm and 1040 nm. Calculated and measured nadir radiances for altitudes of 152 m and 12.5 km agree to within 16% and 14% respectively. The variation in measured radiance with look angle was poorly simulated by the model. It was concluded that an accurate assessment of the source of error will require the inclusion in the analysis of the contributions made by the sea state and specular sky reflectance. Author

N79-22590*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY OF DETERMINING FLAT ROOF HEAT LOSSES USING AERIAL THERMOGRAPHY
Robert L. Bowman and John R. Jack 1979 17 p refs Presented at the 13th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 23-27 Apr. 1979; sponsored by Mich. Univ.
(NASA-TM-79152; E-9981) Avail: NTIS HC A02/MF A01 CSCL 13B

The utility of aerial thermography for determining rooftop heat losses was investigated experimentally using several completely instrumented test roofs with known thermal resistances. Actual rooftop heat losses were obtained both from in-situ instrumentation and aerial thermography obtained from overflights at an altitude of 305 m. In general, the remotely determined roof surface temperatures agreed very well with those obtained from ground measurements. The roof heat losses calculated using the remotely determined roof temperature agreed to within 17% of those calculated from 1/R delta T using ground measurements. However, this agreement may be fortuitous since the convective component of the heat loss is sensitive to small changes in roof temperature and to the average heat transfer coefficient used, whereas the radiative component is less sensitive. This, at this time, it is felt that an acceptable quantitative determination of roof heat losses using aerial thermography is only feasible when the convective term is accurately known or minimized. The sensitivity of the heat loss determination to environmental conditions was also evaluated. The analysis showed that the most reliable quantitative heat loss determinations can probably be obtained from aerial thermography taken under conditions of total cloud cover with low wind speeds and at low ambient temperatures. Author

N79-22591*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TROPHIC CLASSIFICATION OF SELECTED COLORADO LAKES
Richard J. Blackwell and Dale H. P. Boland (EPA) Jan. 1979 210 p refs Sponsored by NASA and EPA Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-158500; EPA-600/4-79-0057; JPL-PUB-78-100) Avail: NTIS HC A10/MF A01 CSCL 08H

Multispectral scanner data, acquired over several Colorado lakes using LANDSAT-1 and aircraft, were used in conjunction with contact-sensed water quality data to determine the feasibility of assessing lacustrine trophic levels. A trophic state index was developed using contact-sensed data for several trophic indicators. Relationships between the digitally processed multispectral scanner data, several trophic indicators, and the trophic index were examined using a supervised multispectral classification technique and regression techniques. Statistically significant correlations exist between spectral bands, several of the trophic indicators and the trophic state index. Color-coded photomaps were generated which depict the spectral aspects of trophic state. Author

N79-22592*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COLOR ENHANCEMENT OF LANDSAT AGRICULTURAL IMAGERY: JPL LACIE IMAGE PROCESSING SUPPORT TASK Final Report
D. P. Madura, James M. Soha, William B. Green, David B. Wherry, and Stanley D. Lewis 15 Dec. 1978 59 p refs
(Contract NAS7-100)
(NASA-CR-158516; JPL-PUB-78-102) Avail: NTIS HC A04/MF A01

Color enhancement techniques were applied to LACIE LANDSAT segments to determine if such enhancement can assist analysis in crop identification. The procedure involved increasing the color range by removing correlation between components. First, a principal component transformation was performed, followed by contrast enhancement to equalize component variances, followed by an inverse transformation to restore familiar color relationships. Filtering was applied to lower order components to reduce color speckle in the enhanced products. Use of single acquisition and multiple acquisition statistics to control the enhancement were compared, and the effects of normalization investigated. Evaluation is left to LACIE personnel. Author

N79-22593# Perkin-Elmer Corp., Norwalk, Conn.
CONTOUR MAPPING OF DETECTOR ARRAYS Final Technical Report, Mar. 197 - Jul. 1978
D. P. Mathur Griffiss AFB, N. Y. RADC Jul. 1978 90 p
(Contract F19628-77-C-0129)
(AD-A063823; PE-13448-2; RADC-TR-78-162) Avail: NTIS HC A05/MF A01 CSCL 17/5

The anomalous behavior of the extrinsic silicon infrared detectors operating at very low temperatures under very low background photon-flux conditions has been extensively reported. A recent theoretical investigation of Ludman and Silverman addressed the anomalous behavior of these detectors near the contact region. The ohmic contacts to these silicon detectors can be considered as high-low junction contacts. The theory then investigates the variations in the detector responsivity near the contacts in view of the effects at low temperature of the high-low junction contacts. This report describes the results of measurements of responsivity of extrinsic silicon infrared detectors near their ohmic contacts. These detector responsivity measurements were made by utilizing an apparatus developed at The Perkin-Elmer Corporation. This apparatus consists of a source of infrared radiation focused to a spot and mounted on a cryogenic x-y stage. The source of radiation and the cryogenic stage are mounted in the same low background photon flux and low temperature chamber as the detectors. The description of the apparatus and its characterization are also presented in this report. GRA

N79-22594# Control Data Corp., Minneapolis, Minn. Digital Image Systems Div.
DIGITAL CARTOGRAPHIC STUDY AND BENCHMARK Final Technical Report, 4 Jun. 1975 - Oct. 1978
D. J. Panton, M. E. Murphy, and D. S. Hanson Dec. 1978

372 p refs
(Contract DAAG53-75-C-0195)
(AD-A064800; CDC-76003-78-R6; ETL-0168) Avail: NTIS HC A16/MF A01 CSCL 08/2

A flexible algorithm has been developed to meet the changing requirements for generating terrain data from digital stereo sensor records. The algorithm includes an image matching procedure in which parallax components are determined by automatically correlating conjugate image features. The algorithm is adaptive and can handle various types of sensor and natural terrain conditions. Reliability monitoring of the output terrain data is performed on the basis of the in-process analysis of local image areas. The reliability measure dictates various strategies that the algorithm can apply in image areas where automatic correlation is difficult. The algorithm was implemented on a distributive network of parallel digital processors. In this system, production speed is attained because of the inherent parallelism of the modular processors. Flexibility is maintained because the processors are microprogrammable. In this way, new sensor imaging characteristics and new algorithm strategies can be incorporated without disturbing the fundamental software and hardware structure of the system. Production times for compiling a representative stereo model on this parallel configuration far exceed the capability of general-purpose computers. GRA

N79-22595# Army Engineer Topographic Labs., Fort Belvoir, Va.
NEAR SURFACE BATHYMETRY SYSTEM
Gunther Schwarz Nov. 1978 35 p refs
(AD-A064532; ETL-0163) Avail: NTIS HC A03/MF A01 CSCL 08/10

This report describes the Near Surface Bathymetry System built under contract for Defense Mapping Agency - Hydrographic Center. Tests were performed to determine the characteristics and adherence to the specifications set forth in the Purchase Description. This report contains the results of these tests.
Author (GRA)

N79-22596# Maryland Univ., College Park. Water Resources Research Center.
EVALUATION OF ALTERNATIVE STORMWATER MANAGEMENT POLICIES
Richard H. McCuen and Gregory E. Kamedulski Oct. 1978 16 p refs
(Contract DI-14-34-0001-8022)
(PB-291736/7; TR-50; W79-03039; OWRT-A-047-MD(1)) Avail: NTIS HC A02/MF A01 CSCL 13B

Stormwater management is recognized as a requisite to controlling storm runoff from developing areas. To best meet societal needs, numerous policies have been adopted to meet the intent of stormwater management. Unfortuntely, many policies are deficient in their failure both to lead to designs that meet the intent of stormwater management and to provide the proper guidelines for translating policy into a design that provides the maximum benefit to society. Specific deficiencies of many policies include: (1) the use of single frequency; (2) neglect of storm duration; (3) inadequate consideration of maintenance; (4) insensitivity to the importance of soil characteristics; (5) lack of recognition of differences between water quantity and quality control; and (6) lack of consideration of downstream effects of detention storage. The effect of these policy deficiencies were evaluated. GRA

N79-22597# New Mexico Inst. of Mining and Technology, Socorro. New Mexico Bureau of Mines and Mineral Resources.
ESTIMATES OF NEW MEXICO'S FUTURE OIL PRODUCTION INCLUDING RESERVES OF THE 50 LARGEST POOLS
Roy W. Foster, Allan L. Gutjahr, and Glenn H. Warner 1978 59 p refs Prepared in cooperation with State Geologist's Office, Santa Fe, N. Mex.
(PB-291780/5; CIRC-166) Avail: NTIS HC A04/MF A01 CSCL 08I

This report consists of two parts: (1) an estimate of future oil production for New Mexico, including estimates for the northwest and southeast areas, and (2) an analysis of reserves of the 50 largest oil pools are included. Production estimates and data are limited to crude oil. GRA

N79-22598# Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
USE OF NEUTRON ACTIVATABLE TRACERS FOR SIMULATING WATER AND CHEMICAL FLOW THROUGH POROUS MEDIA Final Report, 1 Sep. 1975 - 30 Sep. 1978
F. G. Haaser, W. A. Jester, W. R. Heald, A. S. Rogowski, and J. B. Urban Sep. 1978 323 p
(Contract DI-14-34-0001-6039)
(PB-291337/4; W79-02814; OWRT-A-046-PA(2)) Avail: NTIS HC A14/MF A01 CSCL 07D

The need for noncontaminating underground water tracers is significant. The imbalance between the natural distribution of water in space and time and the distribution man desires will grow with time. This study examines the application of three halogen water tracers - bromine, iodine, and chlorine-and offers recommendations on their acceptability for use in various soils. The bromide ion is a most dependable, accurate tracer for monitoring tests at different well sites. In one test this ion reproduced the accuracy of tritiated water, the best recognized but radioactive and therefore polluting tracer. Application results for the iodide ion as a tracer are described for water tracing of deep systems and limited success for shallow soil systems are demonstrated. GRA

N79-22599# Wisconsin Univ. - Madison. Inst. for Environmental Studies.
THE ECONOMIC GEOGRAPHY OF THE NORTHERN LAKES REGION
James R. Penn and Peter M. Ross Apr. 1978 75 p refs Sponsored by the Rockefeller Foundation
(PB-291824/1; IES-Working-Paper-96) Avail: NTIS HC A04/MF A01 CSCL 08F

The Northern Lakes region is defined as the northern half of the states of Michigan, Wisconsin, and Minnesota; a region that has persistently lagged behind the nation in economic well-being. The study reviews the historical roots of the region's problems, investigates the changing, economic patterns between 1950 and 1970, and evaluates the interstate planning commission charged with coordinating the solution of its problems. The report presents the results of a factor analysis of the economic problems, a shift share analysis of employment levels, a regression analysis of income, and a critical review of five other studies of the Wisconsin part of the region. GRA

N79-22600# Minnesota Univ., St. Paul.
RECLAMATION AND REVEGETATION OF STRIP MINED LAND: A SELECTED BIBLIOGRAPHY OF PUBLICATIONS IN THE UNIVERSITY OF MINNESOTA FORESTRY LIBRARY
Jean Albrecht Jun. 1978 18 p
(PB-290146/0; BIB-SER-1-SUPPL-1) Avail: NTIS HC A02/MF A01 CSCL 13B

A bibliography is presented of nearly 200 references relating to the reclamation and revegetation of strip mined land with the emphasis on tree planting. There is an appendix entitled 'Environmental Effects of Mining in Minnesota'. This bibliography supplements one published by the Forestry Library in 1976.
GRA

N79-22601# Hydrologic Engineering Center, Davis, Calif.
TESTING OF SEVERAL RUNOFF MODELS ON AN URBAN WATERSHED
Jess W. Abbott Oct. 1978 54 p refs
(Grant NSF ENV-77-15668)
(PB-290141/1; TM-34; NSF/RA-780384) Avail: NTIS HC A04/MF A01 CSCL 08H

Serveral models of urban water resource systems were tested and reported with the objective of making a preliminary evaluation of their relative capabilities. Accuracies, and ease of application. For four of the models, plus two variants of one of them, the primary performance criterion was the degree to which simulated values matched observed daily and monthly runoff volumes for the 5.5 square mile Castro Valley Watershed near Oakland, California Tests were also run for several individual runoff events. In order to categorize the models used, four computational

attributes are distinguished: single event simulation models; continuous simulation models; hydraulic routing techniques; and hydrologic computation techniques. GRA

N79-22602# GEOMET, Inc., Gaithersburg, Md.
OKLAHOMA COORDINATE SYSTEM USER'S GUIDE Final Report
Jonathan D. Cook Nov. 1978 215 p refs
(Contract EPA-68-02-2582)
(PB-291526/2; GEOMET-EF-702; EPA-906/9-78-005) Avail: NTIS HC A10/MF A01 CSCL 08B

The Oklahoma Coordinate System (OCS), a single-zone coordinate system covering the State of Oklahoma is described. This is intended to be a comprehensive manual on the system, including the provision of tables and formulas necessary to relate OCS coordinates to other coordinate systems used in Oklahoma. The coordinate system and accompanying materials and User's Guide were developed to aid State and local air quality control personnel in their work aimed at improving and maintaining air quality within Oklahoma. Listings of computer software are provided. GRA

N79-22603# California Univ., Davis. Water Resources Center.
REMOTE SENSING OF PERCHED WATER TABLES, A PILOT STUDY
John E. Estes, David S. Simonett, Larry R. Tinney, C. Elaine Chezra, and Brenda Bowman Oct. 1978 88 p refs Sponsored by Office of Water Res. and Technol.
(PB-291753/2; UCAL-WRC-W-512; Contrib-175; W79-03040; OWRT-B-181-CAL(1)) Avail: NTIS HC A05/MF A01 CSCL 08H

Remote sensing techniques within the spectral range 0.4 micrometer to 23 cm of the electromagnetic spectrum are considered. Imagery from the visible and reflective infrared (aerial camera and LANDSAT scanner), thermal infrared (aircraft scanner), and microwave (both active L-band and passive 45 GHz micrad) region were analyzed. Significant temporal cycles were noted in the seasonal fluctuations of perched water tables as well as crop growth stages. Each of these phenomena plays important roles in establishing the utility of sensor systems to detect vegetative response to perched water tables. Results indicate that the thermal infrared region has unique detection capabilities because of differential subsurface heat flows associated with the presence of perched water tables. GRA

N79-22604# National Weather Service, Salt Lake City, Utah.
BASIC HYDROLOGIC PRINCIPLES
Jan. 1979 42 p refs
(PB-292247/4; NOAA-TM-NWS-WR-136; NOAA-79010804) Avail: NTIS HC A03/MF A01 CSCL 08H

Where adequate data are available and forecasts of the complete hydrograph are required, a reasonable standardized approach to river forecasting was developed. Rainfall---runoff relations are used to estimate the amount of water expected to appear in the streams, while unit hydrograms and streamflow-routing procedures in one form or another, are utilized to determine the time distribution of this water at a forecast point. Stage-discharge relations are then used to convert these flows to stages. Information is given on the procedures for generating a river forecast, on streamflow routing, and hydrographs from basin characteristics. GRA

N79-22605# Texas A&M Univ., College Station. Coll. of Geosciences.
SONAR PROBING AS A MINING AND TUNNELING TOOL Progress Report, 1 Sep. 1977 - 1 Jun. 1978
Robert R. Unterberger Jun. 1978 113 p refs
(Grant NSF APR-76-21764)
(PB-289810/4; NSF/RA-780172) Avail: NTIS HC A06/MF A01 CSCL 08I

A 24 KHz sonar system is used to probe rock salt. This equipment, originally designed for water, has been modified to seep into rocks. A study of coupling fluids was conducted and castor oil, glycerin, and UGL were tested as coupling fluids between the sonar transducer and the rock salt. The best is glycerin which couples a maximum of 80 percent of the sonar energy into the salt. Castor oil and UGL are about equal in coupling efficiency, but noticeably inferior to glycerin. Quarter-wave plates were designed and built to increase the efficiency of sonar coupling to 100. A single test was unsuccessful. Energy reflected by a mismatch of acoustic impedances in getting the sonar energy into the salt, gives rise to reverberation in the transducer mount. A complete matching will solve both problems of efficient energy transfer and no reverberation. A theoretical analysis of the beamwidth in salt for both glycerin and castor oil revealed a difference in the beams with glycerin being more sensitive than castor oil for signals straight ahead, and less sensitive for signals off to an angle. This was experimentally verified. Thus, the use of two different fluids allows a change of the shape of the beam in the salt and helps to determine the direction of arrival of reflected signals. GRA

N79-22606# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
METHANE DRAINAGE STUDY IN THE SUNNYSIDE COALBED, UTAH Report of Investigations
J. H. Perry, G. N. Aul, and Joseph Cervik 1978 17 p refs
(PB-289772/6; BM-RI-8323) Avail: NTIS HC A02/MF A01 CSCL 08I

The Bureau of Mines is conducting research to determine the effectiveness of long holes in degasifying an area of the Upper Split of the Lower Sunnyside coalbed at Kaiser Steel Co.'s Sunnyside No. 1 mine. These holes were drilled from the two outside entries of a section that was closed to mining because of excessive methane emissions. Two holes drilled to 430 and 450 feet, respectively, produced initial gas flows of 160,000 and 127,000 cfd. Sixteen days after the completion of the second hole, the total production declined to just over 144,000 cfd. In 9 months of degasification, over 35 MMcf of commercial quality gas has been removed from the coalbed. The combined daily gas flows declined to 106,000 in the 9-month period. The two holes have reduced face emissions by about 40 pct. GRA

N79-22607# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
EXPERIMENTAL STUDIES ON THE ORIGIN AND ACCUMULATION OF COAL BED GAS Report of Investigations
Ann G. Kim 1978 24 p refs
(PB-289774/2; BM-RI-8317) Avail: NTIS HC A02/MF A01 CSCL 08I

The Bureau of Mines investigated factors that influence the formation of methane and other hydrocarbon gases in coal, which is an integral part of the coalification process. Coalification begins with a biogenetic stage in which plant debris decomposes and peat is formed; methane and CO2 are the predominant gases produced during this stage. During the diagenetic stage of coalification hydrogen and the hydrocarbon gases methane, ethane, ethylene, propane, propylene, butene, iso-and normal butane, and pentane are formed by dissociation of the organic material. Methane may also be produced by a secondary reaction of hydrogen with unsaturates or by the reduction of CO2. The gas contained in coalbeds is a mixture of methane, C2 Through C5 alkanes, Co2, O2, N2, H2, and He; its heating value is equivalent to that of natural gas. The gas content of coal depends on many variables, but an empirical relationship between adsortive capacity, rank, and depth has been observed. GRA

N79-22608# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
TRACER GAS METHOD FOR MEASURING LEAKAGE THROUGH MINE STOPPINGS Report of Investigations
J. E. Matta, S. D. Maksimovic, and Fred N. Kissell 1978 16 p refs
(PB-289864/1; BM-RI-8324) Avail: NTIS HC A02/MF A01 CSCL 08I

The Bureau of Mines has developed a tracer gas method for measuring leakage through permanent mine stoppings. In this method, a temporary brattice is erected in the same entry as the leaking permanent stopping. Leakage was evaluated from concentration measurements of a tracer gas introduced into the space between the stopping and brattice. Stopping leakages ranging from 15 cfm to 265 cfm were simulated in an underground coal mine. Leakage values determined by the new method were within 10 pct of the known values. GRA

N79-22609# Texas Univ. at Austin. Center for Research in Water Resources.
OPTIMIZATION MODEL FOR THE EVALUATION OF FLOOD-CONTROL BENEFITS OF MULTIRESERVOIR SYSTEMS
David T. Ford May 1978 250 p refs Sponsored by Office of Water Research and Technology
(PB-291638/5; CRWR-158; W79-03044; OWRT-C-6268(5224)(1)) Avail: NTIS HC A11/MF A01 CSCL 13B

A methodology is described for quantifying the demand for flood-control in a multipurpose reservoir system and for evaluating the expected benefits of satisfying that demand as a function of beginning-of-period storage, thereby permitting analysis of multipurpose operation with a suitably long computation interval. The methodology is executed in three major steps: (1) analysis of the frequency of natural flows and evaluation of the associated damages to develop damage frequency curves, (2) evaluation of the frequency of damages incurred by regulated flows to various states of system storage via application of an operation optimization model, and (3) integration of the resulting damage frequency curves to determine the expected flood-control benefits. The optimization model used is a linear programming model, formulated with emphasis on selection of operation rules that are acceptable in practice. The benefit evaluation methodology is demonstrated by application to reservoirs of the Arkansas River system. GRA

N79-22610# American Society of Civil Engineers, New York. Urban Water Resources Research Council.
RESEARCH ON THE DESIGN STORM CONCEPT
Jiri Marsalek (Natl. Water Res. Inst., Burlington, Ont.) Sep. 1978 37 p refs
(Grant NSF ENV-77-15668)
(PB-291936/3; NSF/RA-780348; TM-33) Avail: NTIS HC A03/MF A01 CSCL 13B

Analysis was restricted to sewered catchments in a southern Ontario municipality. Streamflow flood frequencies were determined in two ways: (1) runoff flows were simulated for design storms of assigned frequencies of occurrence and it was assumed that the frequencies of the runoff peak flows were identical to those ascribed to the design storms; and (2) runoff flows were simulated for a large number of historical storms and the frequencies of occurrence of various runoff flows were determined directly from the simulated runoff flow record. To establish the frequency of occurrence of runoff peak flow, continuous runoff simulation was approximated by a series of single-event simulations for 27 selected actual storms. GRA

N79-22611# Idaho Univ., Moscow.
EVALUATION OF URBANIZATION AND CHANGES IN LAND USE ON THE WATER RESOURCES OF THE MOUNTAIN VALLEYS Technical Completion Report
C. E. Brockway and Kenneth P. Grover Oct. 1978 127 p refs
(Contract DI-14-34-0001-6701; OWRT Proj. B-038-IDA(1)) (PB-291735/9; W79-03042) Avail: NTIS HC A07/MF A01 CSCL 13B

Impact of projectsed changes in land use on aquifer and stream systems of the Big Wood River-Silver Creek area, S. Idaho was evaluated using a finite difference model of the groundwater system. Water table and confined aquifers were simulated. Simulated groundwater levels and spring flows were determined for projected changes in land use. Severe decreases up to 38% in discharge of Silver Creek, a productive spring fed trout stream were projected. Groundwater levels in water table and artesian aquifers could decline up to 16 feet. Most severe impacts result from conversion of present flood end furrow irrigated land to sprinkler irrigation with attendant decreases in aquifer recharge. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-22612 California Univ., Berkeley.
RESPONSES OF SOUTHERN CALIFORNIA BRUSHLAND VEGETATION TO FUEL MANIPULATION Ph.D. Thesis
Ronald Haruto Wakimoto 1978 274 p
Avail: Univ. Microfilms Order No. 7904641

The response of seven chaparral shrub species to fuel manipulation was studied in central San Diego County. Response was measured in terms of net biomass accumulation following manipulation. This biomass accumulation of each species was characterized as a fire fuel. In addition to the fuel characteristics studied, linear regression models for estimating biomass of standing shrubs were developed using the data from the individual plants sampled. Such biomass estimation models were needed to facilitate inventory of standing vegetation in a non-destructive manner. Dissert. Abstr.

N79-22613* New Mexico Univ., Albuquerque. Technology Application Center.
HYDROGEN ENERGY. A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, Oct. - Dec. 1978
Oct. 1978 65 p Sponsored by NASA
(NASA-CR-157962; TAC-H78-004) Avail: NTIS HC A04 for foreign requestors only. Domestic orders, Univ. of New Mexico Tech. Application Center, Albuquerque CSCL 10B

Hydrogen Energy is a continuing bibliographic summary with abstracts of research and projections on the subject of hydrogen as a secondary fuel and as an energy carrier. This update to Hydrogen Energy cites additional references identified during the fourth quarter of 1978. It is the fourth in a 1978 quarterly series intended to provide current awareness to those interested in hydrogen energy. A series of cross indexes are included which track directly with those of the cumulative volume. G.Y.

N79-22614* New Mexico Univ., Albuquerque. Technology Application Center.
SOLAR THERMAL POWER GENERATION. A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, Jul. - Sep. 1978
Jan. 1979 138 p Sponsored by NASA
(NASA-CR-158004; TAC-STPG-78-003) Avail: NTIS HC A07 for foreign requestors only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque , CSCL 10B

Bibliographies and abstracts are cited under the following topics: (1) energy overviews; (2) solar overviews; (3) conservation; (4) economics, law; (5) thermal power; (6) thermionic, thermoelectric; (7) ocean; (8) wind power; (9) biomass and photochemical; and (10) large photovoltaics. G.Y.

N79-22615*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTRODUCTORY ASSESSMENT OF ORBITING REFLECTIONS FOR TERRESTRIAL POWER GENERATION
Kenneth W. Billman, William P. Gilbreath, and Stuart W. Bowen Apr. 1977 58 p refs
(NASA-TM-73230; A-6996) Avail: NTIS HC A04/MF A01 CSCL 10A

The use of orbiting mirrors for providing energy to ground conversion stations to produce electrical power is shown to be a viable, cost effective and environmentally sound alternative to satellite solar power stations and conventional power sources. This is accomplished with the use of very light weight metal coated polymeric films as mirrors which, after deployment at 800 km, are placed in operational orbit and controlled by solar radiation pressure. Relations are developed showing the influence of a number of parameters (mirror altitude, orbit inclination, period,

mirror size and number, and atmospheric effects) on the reflected insolation that may be received by a ground spot as a function of location. Some attractive alternative uses of the reflection are briefly discussed as a beneficial adjuncts to the system.
Author

N79-22616*# Boeing Aerospace Co., Seattle, Wash.
SYSTEMS DEFINITION SPACE BASED POWER CONVERSION SYSTEMS: EXECUTIVE SUMMARY Final Report
1977 29 p refs
(Contract NAS8-31628)
(NASA-CR-150209; D180-20309-1) Avail: NTIS HC A03/MF A01 CSCL 10B

Potential space-located systems for the generation of electrical power for use on earth were investigated. These systems were of three basic types: (1) systems producing electrical power from solar energy; (2) systems producing electrical power from nuclear reactors; (3) systems for augmenting ground-based solar power plants by orbital sunlight reflectors. Configurations implementing these concepts were developed through an optimization process intended to yield the lowest cost for each. A complete program was developed for each concept, identifying required production rates, quantities of launches, required facilities, etc. Each program was costed in order to provide the electric power cost appropriate to each concept. G.Y.

N79-22617*# ECON, Inc., Princeton, N. J.
SPACE-BASED SOLAR POWER CONVERSION AND DELIVERY SYSTEMS STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report, 30 Sep. 1976 - 31 Mar. 1977
31 Mar. 1977 49 p 5 Vol.
(Contract NAS8-31308)
(NASA-CR-150294; Rept-77-145-1-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 10B

The research concerning space-based solar power conversion and delivery systems is summarized. The potential concepts for a photovoltaic satellite solar power system was studied with emphasis on ground output power levels of 5,000 MW and 10,000 MW. A power relay satellite, and certain aspects of the economics of these systems were also studied. A second study phase examined in greater depth the technical and economic aspects of satellite solar power systems. Throughout this study, the focus was on the economics of satellite solar power. The results indicate technical feasibility of the concept, and provide a preliminary economic justification for the first phase of a substantial development program. A development program containing test satellites is recommended. Also, development of alternative solar cell materials (other than silicon) is recommended. F.O.S.

N79-22618*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE-BASED SOLAR POWER CONVERSION AND DELIVERY SYSTEMS STUDY. VOLUME 2: ENGINEERING ANALYSIS Final Report
31 Mar. 1977 264 p refs Prepared for ECON, Inc., Princeton, N. J.
(Contract NAS8-31308)
(NASA-CR-150295) Avail: NTIS HC A12/MF A01 CSCL 10B

The technical and economic feasibility of Satellite Solar Power Systems was studied with emphasis on the analysis and definition of an integrated strawman configuration concept, from which credible cost data could be estimated. Specifically, system concepts for each of the major subprogram areas were formulated, analyzed, and iterated to the degree necessary for establishing an overall, workable baseline system design. Cost data were estimated for the baseline and used to conduct economic analyses. The baseline concept selected was a 5-GW crystal silicon truss-type photovoltaic configuration, which represented the most mature concept available. The overall results and major findings, and the results of technical analyses performed during the final phase of the study efforts are reported. F.O.S.

N79-22619*# Raytheon Co., Wayland, Mass. Equipment Div.
SPACE-BASED SOLAR POWER CONVERSION AND DELIVERY SYSTEMS STUDY. VOLUME 3: MICROWAVE POWER TRANSMISSION STUDIES Final Report
1 Mar. 1977 195 p refs Prepared for ECON, Inc., Princeton, N. J.
(Contract NAS8-31308)
(NASA-CR-150296) Avail: NTIS HC A09/MF A01 CSCL 10B

The Microwave Fower Beam Ionosphere effects and critical interfaces between th Microwave Power Transmission System (MPTS) and the Satellite were studied as part of the NASA/MSFC continuing research on the feasibility of power transmission from geosynchronous orbit. Theoretical predications of ionospheric modifications produced by the direct interaction of the MPTS on the earth's upper atmosphere are used to determine their impact on the performance of the Microwave Power Beam and Pilot Beam System as well as on other RF systems effected by the ionosphere. A technology program to quantitatively define these interactions is developed. Critical interface areas between the MPTS and the sateilite which could have a major impact on cost and performance of the power system are idenfified and analyzed. The areas selected include: use of either a 20 kV versus 40 kV Amplitron, thermal blockage effects of Amplitron heat radiation by the satellite structure, effect of dielectric carry-through structure on power beam, and effect of material sublimation on performance of the Amplitron in Geosynchronous Orbit. F.O.S.

N79-22620*# Little (Arthur D.), Inc., Cambridge, Mass.
SPACE-BASED SOLAR POWER CONVERSION AND DELIVERY SYSTEMS STUDY. VOLUME 4: ENERGY CONVERSION SYSTEMS STUDIES Final Report
29 Mar. 1977 74 p refs Prepared for ECON, Inc., Princeton, N. J.
(Contract NAS8-31308)
(NASA-CR-150297; C-78127-Vol-4) Avail: NTIS HC A04/MF A01 CSCL 10B

Solar cells and optical configurations for the SSPS were examined. In this task, three specific solar cell materials were examined: single crystal silicon, single crystal gallium arsenide, and polycrystalline cadmium sulfide. The comparison of the three different cells on the basis of a subsystem parametric cost per kW of SSPS-generated power at the terrestrial utility interface showed that gallium arsenide was the most promising solar cell material at high concentration ratios. The most promising solar cell material with no concentration, was dependent upon the particular combination of parameters representing cost, mass and performance that were chosen to represent each cell in this deterministic comparative analysis. The potential for mass production, based on the projections of the present state-of-the-art would tend to favor cadmium sulfide in lieu of single crystal silicon or gallium arsenide solar cells. F.O.S.

N79-22621*# ECON, Inc., Princeton, N. J.
SPACE-BASED SOLAR POWER CONVERSION AND DELIVERY SYSTEMS STUDY. VOLUME 5: ECONOMIC ANALYSIS Final Report
31 Mar. 1977 279 p refs
(Contract NAS8-31308)
(NASA-CR-150298; Rept-77-145-1-Vol-5) Avail: NTIS HC A13/MF A01 CSCL 10B

Space-based solar power conversion and delivery systems are studied along with a variety of economic and programmatic issues relevant to their development and deployment. The costs, uncertainties and risks associated with the current photovoltaic Satellite Solar Power System (SSPS) configuration, and issues affecting the development of an economically viable SSPS development program are addressed. In particular, the desirability of low earth orbit (LEO) and geosynchronous (GEO) test satellites is examined and critical technology areas are identified. The development of SSPS unit production (nth item), and operation and maintenance cost models suitable for incorporation into a risk assessment (Monte Carlo) model (RAM) are reported. The RAM was then used to evaluate the current SSPS configuration expected costs and cost-risk associated with this configuration. By examining differential costs and cost-risk as a function of postulated technology developments, the critical technologies, that is, those which drive costs and/or cost-risk, are identified. It is shown that the key technology area deals with productivity in space, that is, the ability to fabricate and assemble large structures in space, not, as might be expected, with some hardware component technology. F.O.S.

N79-22622*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR TRACKING CONTROL SYSTEM SUN CHASER
D. R. Scott and P. R. White Apr. 1979 17 p Supersedes NASA-TM-78199 Prepared for DOE
(NASA-TM-78225) Avail: NTIS HC A02/MF A01 CSCL 10A

The solar tracking control system (Sun Chaser) is believed to be an improved method of tracking the Sun in all types of weather conditions. The Sun Chaser will follow the Sun from east to west in clear or cloudy weather, and reset itself to the east position after sundown in readiness for the next sunrise. A description of the Sun Chaser hardware and its operation together with results is presented. L.S.

N79-22623*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY COMPARISON OF THEORY AND EXPERIMENT FOR A CONICAL, PRESSURIZED-FLUIDIZED-BED COAL COMBUSTOR
R. W. Patch Mar. 1979 56 p refs
(NASA-TM-79137; E-9985) Avail: NTIS HC A04/MF A01 CSCL 10A

A published model was used for a comparison of theory with an actual combustor burning caking bituminous coal and using limestone to reduce sulfur dioxide emission. Theoretical bed pressure drop was in good agreement with experiment. The burnable carbon elutriated was not in agreement with experiment, at least partly because the exhaust port was apparently below the transport disengaging height. The observed nitrogen oxides emission rate was about half the theoretical value. There was order-or-magnitude agreement of sulfur dioxide emission rates. Author

N79-22624*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF A FUEL CELL ON-SITE INTEGRATED ENERGY SYSTEM FOR A RESIDENTIAL COMPLEX
Stephen N. Simons and William L. Maag (Solar Energy Products Co., Avon Lake, Ohio) 1979 11 p refs Proposed for presentation at the Terrest. Energy Systems Conf., Orlando, Fla., 4-6 Jun. 1979; sponsored by AIAA
(NASA-TM-79161; E-018) Avail: NTIS HC A02/MF A01 CSCL 10B

Declining supplies of domestic oil and gas and the increased cost of energy resulted in a renewed emphasis in utilizing available resources in the most efficient manner possible. This, in turn, brought about a reassessment of a number of methods for converting fossil fuels to end uses at the highest practical efficiency. One of these is the on-site integrated energy system (OS/IES). This system provides electric power from an on-site power plant and recovers heat from the power plant that would normally be rejected to the environment. An OS/IES is potentially useful in any application that requires both electricity and heat. Several OS/IES are analyzed for a residential complex. The paper is divided into two sections; the first compares three energy supply systems, the second compares various designs for fuel cell OS/IES. L.S.

N79-22625*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Mathematical and Computing Sciences.
LONG-TERM TEMPERATURE EFFECTS ON GaAs SOLAR CELLS Final Report, 1 Jan. 1978 - 15 Apr. 1979
John H. Heinbockel and Ki H. Hong Apr. 1979 61 p refs
(Grant NsG-1465)
(NASA-CR-158491) Avail: NTIS HC A04/MF A01 CSCL 10A

The thermal degradation of AlGaAs solar cells resulting from a long-term operation in a space environment is investigated. The solar cell degradation effects caused by zinc and aluminum diffusion as well as deterioration by arsenic evaporation are presented. Also, the results are presented of experimental testing and measurements of various GaAs solar cell properties while the solar cell was operating in the temperature range of 27 C to 350 C. In particular, the properties of light current voltage curves, dark current voltage curves, and spectral response characteristics are given. Finally, some theoretical models for the annealing of radiation damage over various times and temperatures are included. J.M.S.

N79-22626*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF STEAM ADDITION ON CYCLE PERFORMANCE OF SIMPLE AND RECUPERATED GAS TURBINES
Robert J. Boyle Apr. 1979 52 p refs
(NASA-TP-1440; E-9795) Avail: NTIS HC A04/MF A01 CSCL 10B

Results are presented for the cycle efficiency and specific power of simple and recuperated gas turbine cycles in which steam is generated and used to increase turbine flow. Calculations showed significant improvements in cycle efficiency and specific power by adding steam. The calculations were made using component efficiencies and loss assumptions typical of stationary powerplants. These results are presented for a range of operating temperatures and pressures. Relative heat exchanger size and the water use rate are also examined. Author

N79-22627*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED SUBSYSTEMS DEVELOPMENT Semiannual Progress Report, 1 Apr. - 1 Oct. 1978
Floyd Livingston 15 Nov. 1978 255 p refs Prepared for DOE
(Contract NAS7-100; JPL Proj. 5102-89)
(NASA-CR-158335; SAPR-2; JPL-PUB-79-24; DOE/JPL-1060-6) Avail: NTIS HC A12/MF A01 CSCL 10B

The concept design for a small (less than 10 MWe) solar thermal electric generating plant was completed using projected 1985 technology. The systems requirements were defined and specified. The components, including an engineering prototype for one 15 kWe module of the generating plant, were conceptually designed. Significant features of the small solar thermal power plant were identified as the following: (1) 15 kWe Stirling-cycle engine/alternator with constant power output; (2) 10 meter point-focusing paraboloidal concentrator with cantilevered cellular glass reflecting panels; (3) primary heat pipe with 800 C output solar cavity receiver; (4) secondary heat pipe with molten salt thermal energy storage unit; (5) electric energy transport system; and (6) advanced battery energy storage capability. G.Y.

N79-22628*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENVIRONMENTAL TESTING OF BLOCK 2 SOLAR CELL MODULES
J. S. Griffith 1 Jan. 1979 53 p refs Prepared for DOE
(Contract NAS7-100)
(NASA-CR-158521; JPL-PUB-79-5; DOE/JPL-1012-79/1) Avail: NTIS HC A04/MF A01 CSCL 10A

The testing procedures and results of samples of the LSA Project Block 2 procurement of silicon solar cell modules are described. Block 2 was the second large scale procurement of silicon solar cell modules made by the JPL Low-cost Solar Array Project with deliveries in 1977 and early 1978. The results showed that the Block 2 modules were greatly improved over Block 1 modules. In several cases it was shown that design improvements were needed to reduce environmental test degradation. These improvements were incorporated during this production run. S.E.S.

N79-22629*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL POWER SYSTEMS SMALL POWER SYSTEMS APPLICATION PROJECT: SITING ISSUES FOR SOLAR THERMAL POWER PLANTS WITH SMALL COMMUNITY APPLICATIONS
H. J. Holbeck and S. J. Ireland 1 Feb. 1979 45 p refs Prepared for DOE
(Contract NAS7-100; JPL Proj. 5103-50)
(NASA-CR-15820; JPL-PUB-78-75-Rev-1) Avail: NTIS HC A03/MF A01 CSCL 10B

The siting issues associated with small, dispersed solar thermal power plants for utility/small community applications of less than 10 MWe are reported. Some specific requirements are refered to the first engineering experiment for the Small Power Systems Applications (SPSA) Project. The background for the subsequent issue discussions is provided. The SPSA Project and the requirements for the first engineering experiment are described, and the objectives and scope for the report as a whole. A overview of solar thermal technologies and some technology options are discussed. S.E.S.

N79-22630*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 5: ELECTRICAL CHARACTERISTICS OF OCLI 225-MICRON MLAR WRAPAROUND CELLS AS A FUNCTION OF INTENSITY, TEMPERATURE, AND IRRADIATION
B. E. Anspaugh, T. F. Miyahira, and R. S. Weiss 1 Apr. 1979 64 p refs
(Contract NAS7-100)
(NASA-CR-158501; JPL-PUB-78-15-Vol-5) Avail: NTIS HC A04/MF A01 CSCL 10A

Computed statistical averages and standard deviations with respect to the measured cells for each intensity temperature measurement condition are presented. Display averages and standard deviations of the cell characteristics in a two dimensional array format are shown: one dimension representing incoming light intensity, and another, the cell temperature. Programs for calculating the temperature coefficients of the pertinent cell electrical parameters are presented, and postirradiation data are summarized. M.M.M.

N79-22631*# Xerox Electro-Optical Systems, Pasadena, Calif.
RESEARCH ON ENERGY STORAGE FOR SOLAR THERMAL CONVERSION Final Report
James L. Clayton Oct. 1978 128 p refs Sponsored by NASA
(Grant NSF C-7522234)
(NASA-CR-159427) Avail: NTIS HC A07/MF A01 CSCL 10A

Thermal energy storage (TES) for solar thermal energy conversion to electric power was studied. Major emphasis was placed on determining the relative merits of latent, sensible, and hybrid latent-sensible storage systems. The thermal energy storage systems evaluated are compatible with 10 MW and 100 MW steam power plants with TES delivery temperature ranges of 400 to 600 F and 900 to 110 F. Also evaluated is a 200 kW - 2000 kW combination total energy system. The initial phase of the study involved a review of storage material thermophysical properties and analysis of the phase change heat transfer mechanism. Analytical studies presented include TES parametric and steam cycle analyses. Design studies were performed and resulting TES system designs are presented. Major TES cost factors are evaluated and summarized. Finally, TES system reliability, safety, and environmental effects are presented. It is concluded that a hybrid latent-sensible energy storage system is most efficient from a thermodynamic viewpoint for use in conjunction with a steam power plant. Sensible energy storage is presently less costly to implement than latent storage utilizing current heat exchanger technology, however latent energy storage offers high energy density and the potential for future cost reduction. Author

N79-22632*# Rockwell International Corp., Downey, Calif. Space Systems Group.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY EXHIBIT C. VOLUME 3: EXPERIMENTAL VERIFICATION DEFINITION Final Report
Mar. 1979 152 p
(Contract NAS8-32475)
(NASA-CR-161214; SSD-79-0010-3) Avail: NTIS HC A08/MF A01 CSCL 10B

An environmentally oriented microwave technology exploratory research program aimed at reducing the uncertainty associated with microwave power system critical technical issues is described. Topics discussed include: (1) Solar Power Satellite System (SPS) development plan elements; (2) critical technology issues related to the SPS preliminary reference configuration; (3) pilot plant to demonstrate commercial viability of the SPS system; and (4) research areas required to demonstrate feasibility of the SPS system. Progress in the development of advanced GaAs solar cells is reported along with a power distribution subsystem. J.M.S.

N79-22633*# Rockwell International Corp., Downey, Calif. Space Systems Group.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY, EXHIBIT C. VOLUME 5: SPECIAL EMPHASIS STUDIES Final Report
G. Hanley Mar. 1979 265 p refs
(Contract NAS8-32475)
(NASA-CR-161215; SSD-79-0010-5) Avail: NTIS HC A12/MF A01 CSCL 10B

Specific areas were analyzed and identified as high priority for more in-depth analysis. These areas were: (1) rectenna constructability; (2) satellite constructability; (3) support systems constructability; (4) space environmental analysis, and (5) special end-to-end analyses. Baseline requirements specified coplanar solar blankets and an end mounted antenna, utilizing either GaAlAs solar cells and employing a CR of 2, or Si cells. Several configurations were analyzed. Utilizing the preferred configuration as a baseline, a satellite construction base was defined, precursor operations incident to establishment of orbital support facilities identified, and the satellite construction sequence and procedures developed. Since the baseline specifies sixty instead of one hundred and twenty satellites to be constructed in a thirty year period, mass flow to orbit requirements were revised and new traffic models established. Launch site requirements (exclusive of actual launch operations) in terms of manpower and building space were defined. J.M.S.

N79-22634*# Rockwell International Corp., Downey, Calif. Space Systems Group.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY, EXHIBIT C. VOLUME 6: IN-DEPTH ELEMENT INVESTIGATION Final Report
G. Hanley Mar. 1979 97 p refs
(Contract NAS8-32475)
(NASA-CR-161216; SSD-79-0010-6) Avail: NTIS HC A05/MF A01 CSCL 10B

Computer assisted design of a gallium arsenide solid state dc-to-RF converter with supportive fabrication data was investigated. Specific tasks performed include: computer program checkout; amplifier comparisons; computer design analysis of GaSa solar cells; and GaAs diode evaluation. Results obtained in the design and evaluation of transistors for the microwave space power system are presented. J.M.S.

N79-22635# Little (Arthur D.), Inc., Cambridge, Mass.
EPRI METHODOLOGY FOR PREFERRED SOLAR SYSTEMS (EMPSS) COMPUTER PROGRAM DOCUMENTATION. USER'S GUIDE
Dan Nathanson and Richard L. Merriam May 1978 275 p refs Sponsored by EPRI
(EPRI Proj. RP549)
(EPRI-ER-771) Avail: NTIS HC A12/MF A01

A computer program was developed by which the behavior of residential solar heating and cooling systems could be analyzed. Unlike several other programs by which buildings and the performance solar heating and cooling equipment can be analyzed, this program is capable of estimating the cost of backup electrical energy from a utility's actual cost of supply, in addition to its rate structures. In its present form the program permits the specification of a wide variety of solar or conventional heating and cooling devices which use electrical energy. Both the thermal loads of the residence and the utility's system-wide load are dependent upon a weather tape which is used in hourly computations extending over one year. Monthly costs of electrical energy are based upon the hourly electrical demand of the residence and the utility's cost-of-supply model. When combined with equipment costs and specified economic parameters, these monthly energy costs are used to predict total life-cycle costs for each system considered, and to show payback periods when compared with conventional equipment. Detailed descriptions of the program elements and of its input and output data streams are provided. DOE

N79-22636# Mallory Battery Co., Tarrytown, N. Y.
PRIMARY LITHIUM ORGANIC ELECTROLYTE BATTERY BA-5090 ( )/U, BA-5585 ( )/U, BA-5598 ( )/U Final Report, 1 May 1976 - 30 Dec. 1978
J. Barrella and M. Kumbhani Dec. 1978 103 p refs
(Contract DAAB07-76-C-1735)
(AD-A064327; DELET-TR-76-1735-F) Avail: NTIS HC A06/MF A01 CSCL 10/3

The primary objective of this program was to investigate the effects of variations of cell component ratios on cell safety

and electrical performance. Included in these studies was the evaluation of potential vent design changes for capacity optimization. Hermetically sealed cells and batteries already in production were utilized as the basic test vehicles. The objective of this program was to design and develop a new cell for use in the BA-5090 battery. Due to its unique size this LO37S cell required special manufacturing techniques not previously developed. Primary concern throughout this section was to maximize utilizable capacity while complying with design criteria developed in Section 1. Author (GRA)

N79-22637# Chrysler Corp., New Orleans, La. Defense-Space Div.
DEVELOPMENT OF A NICAD BATTERY INTERFACE UNIT Final Report, Jul. 1976 - May 1978
Earnest Stephens Dec. 1978 75 p
(Contract DAAJ02-76-C-0054)
(AD-A064290; USARTL-TR-78-47) Avail: NTIS HC A04/MF A01 CSCL 10/3

This report describes the effort to develop and test a Battery Interface Unit (BIU) for use on Army aircraft. The BIU provides a means to charge and monitor the status of nickel-cadmium batteries and is an onboard unit that can be readily integrated with the existing aircraft electrical system. The initial portion of the multitask program involved definition of candidate approaches, analysis to select the optimum approach, and design of a system to implement the multilevel, constant current approach selected as optimum. Six BIU's were then fabricated, three to operate with an AC input and three to operate from a DC input; they were subjected to a variety of performance and environmental tests to demonstrate performance. The objectives of the program were to develop a system that would reduce battery maintenance cost, increase the useful life of NICAD batteries, and eliminate battery-related safety hazards. The results of the program clearly demonstrated that a BIU can be built which meets these objectives and which can be packaged within weight and volume limits compatible with onboard aircraft usage. Author (GRA)

N79-22638# Grumman Aerospace Corp., Bethpage, N.Y.
RECOVERY OF WASTE HEAT FROM PROPELLANT FORCED-AIR DRY HOUSE Final Report, Nov 1976 - Apr. 1978
Joseph Alario, Eugene F. Bezza, and Peter Mullaney Dec. 1978 104 p refs
(Contract DAAA21-77-C-0021)
(AD-A064108; AD-E400264; ARLCD-CR-78029) Avail: NTIS HC A06/MF A01 CSCL 13/1

This report describes the design, installation, and test evaluation of a heat pipe heat exchanger for a multi-base propellant forced-air dry house for the purpose of recovering heat from the hot air exhausted to the atmosphere during a typical drying operation. Detailed descriptions of the special safety and operating features of the recovery unit are also presented. Evaluation of the unit showed that approximately 62% of the energy used to dry multi-base propellants can be saved by the heat recovery technique employed. Energy/cost saving projections are based upon the installation of similar recovery units at a major Army propellant manufacturing facility such as Radford Army Ammunition Plant. Author (GRA)

N79-22639# Maxwell Labs., Inc., Woburn, Mass.
HIGH POWER MAGNETOHYDRODYNAMIC SYSTEM, VOLUME 1 Final Technical Report, 17 May 1976 - 15 Jun. 1978
D. W. Swallom, O. K. Sonju, D. E. Meader, and H. Becker Jul. 1978 375 p refs
(Contract F33615-76-C-2104; AF Proj. 3145)
(AD-A064796; AFAPL-TR-78-51-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 10/2

During this phase a lightweight, high performance hot gas flow train using liquid oxygen and JP-4 was designed and component modeling completed. The magnetohydrodynamic channel/diffuser performance parameters which were used as the design criteria were an output power of 30 MWe, a specific energy extraction of 1.0 MJ/kg, and a specfic power density of 200 MWe/cu m. To achieve these performance requirements, the required characteristic velocity efficiency of the combustion system was greater than 99%. During this program a limited amount of development testing was completed using a heat sink combustor and a diagnostics channel. These tests measured the combustor characteristic velocity efficiency and the gas electrical conductivity, as well as pressures, vibrations, and temperatures. The results of the development test program, which verified the design assumptions used to achieve the performance requirements, were a characteristic velocity efficiency of nearly 99% and a gas electrical conductivity at the magnetohydrodynamic channel inlet of 15 mhos/m. GRA

N79-22640# Maxwell Labs., Inc., Woburn, Mass.
HIGH POWER MAGNETOHYDRODYNAMIC SYSTEM, VOLUME 2 Final Report, 17 May 1976 - 15 Jun. 1978
D. W. Swallom, Otto K. Sonju, D. E. Meader, and H. Becker Jul. 1978 316 p refs
(Contract F33615-76-C-2104; AF Proj. 3145)
(AD-A064435; AFAPL-TR-78-51-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 10/2

The technical effort discussed in this report covers Phase B of the High Power Magnetohydrodynamic System program, which is a multi-phase program to develop liquid oxygen/liquid hydrocarbon magnetrohydrodynamic generators using cesium seed for high performance, portable power supply applications. During this phase a lightweight, high performance hot gas flow train using liquid oxygen and JP-4 was designed and component modeling completed. GRA

N79-22641# State Univ. of New York at Buffalo. Dept. of Chemistry.
FUNDAMENTAL SOLID ELECTRODE STUDIES RELATED TO CORROSION PREVENTION, FUEL CELLS AND BATTERIES Final Report, 1 Aug. 1973 - 15 May 1978
Stanley Bruckenstein May 1978 17 p refs
(Grant AF-AFOSR-2572-74)
(AD-A064554; AFOSR-79-0033TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The study of surface phenomena at solid electrodes related to electrochemical power sources and corrosion processes was the major goal of this research. In particular, three kinds of surface processes were investigated: (1) underpotential metal deposition, (2) neutral species adsorption and (3) insoluble film formation. New electroanalytical and electrochemical techniques were developed specifically for the purpose of studying such surface processes. These techniques made it possible to prepare solutions with extremely low levels of poisoning substances, to distinguish between surface and mass transport controlled processes, and to perform quantitative studies at the micromolar levels of electroactive species that arose in our studies. Underpotential deposition, UPD, of thallium, mercury and silver on gold have resulted in the determination of accurate adsorption isotherms and highly precise determination of the electrosorption valency. Electrosorption valency values for silver show a minimum near a surface coverage of 0.5. No minimum has ever been discovered before. It is believed that this minimum is caused by either a superlattice phenomena and/or a change in double layer structure. Mercury UPD studies established the existence of a spontaneous coulostatic process that can produce UPD for open circuited metal electrodes. Carbon monoxide, selected as a model neutral species adsorbate, was shown to exist in a number of adsorbed states on platinum. GRA

N79-22642# Spectrolab, Inc., Sylmar, Calif.
HIGH EFFICIENCY SOLAR PANEL (HESP-2) Final Report
P. M. Stella, F. M. Uno, and Jay W. Thornhill Aug. 1978 74 p refs
(Contract F33615-77-C-3108)
(AD-A065009; AFAPL-TR-78-60) Avail: NTIS HC A05/MF A01 CSCL 10/2

The objective of this program is to develop space qualified weapon survivable silicon solar cells having a BOL conversion efficency of 16% at 25 C under AMO illumination. After seven (7) years in the synchronous orbit environment (approximately 3 x 10 exp (14) 1 meV electrons/square centimeter equivalent irradiation) the cells shall not degrade more than 13% in conversion efficiency. The status of the work at this point and the performance of the most recent state-of-the-art cells delivered as representative samples are reported. The results obtained to date indicate that some of the processes chosen for optimization

have not proven as fruitful as orginally anticipated, while others have demonstrated marked success. The task now is to integrate these various optimizations into an integrated sequence to fabricate cells that meet or surpass the requirements. A list of possible additional investigations, which appear pertinent and useful to this effort, is included in the section entitled Recommendations. Author (GRA)

N79-22643# Virginia Highway and Transportation Research Council, Charlottesville.
OPPORTUNITIES FOR ENERGY CONSERVATION IN TRANSPORTATION PLANNING AND SYSTEMS MANAGEMENT Final Report, Jul. 1977 - Nov. 1978
Eugene D. Arnold, Jr. Nov. 1978 81 p refs
(PB-291743/3; VHTRC-79-R24; FHWA/VA-79-R24) Avail: NTIS HC A05/MF A01 CSCL 13B

A summary is presented based primarily on a literature review, of the energy-savings potential of the elements in the transportation planning process and systems management. Within the scope of long-range planning, the energy aspects of land use and mode of transportation were investigated, whereas for the short range the energy potential of the various transportation systems management strategies were considered. The role of the Virginia Department of Highways and Transportation in energy-saving activities was considered. The report should be value to transportation planners and traffic engineers as an overview of the energy-use characteristics of activities within transportation planning and systems management and as a resource document for detailed energy analyses. GRA

N79-22644# Nevada Univ., Reno. Atmospheric Sciences Center.
STUDIES OF A SALT HYDRATE HEAT STORAGE SYSTEM Final Report
L. Christensen, N. Cho, G. Keyser, D. Lamb, and E. Wedum Aug. 1978 114 p refs
(Grant NSF AER-75-19601)
(PB-291586/6; NSF/RA-780378) Avail: NTIS HC A06/MF A01 CSCL 07D

Crystallization of a one and two component system for thermal storage by fusion heat of salt hydrates was investigated for sodium sulfate (10H2O); sodium thiosulfate (5H2O) and sodium acetate (3H2O). A continuous input of small crystals which grew and sedimented from the solution aimed to keep heat transfer surfaces crystal free. The two component system utilized kerosene as the heat transfer fluid, and was circulated as mm drops rising by buoyancy through the salt solution. Both of these systems resulted, under appropriate operating conditions, in the formation of secondary crystals to replace those which grew and sedimented. The one component system proved unreliable. The two component system functioned when crystal concentration was sufficiently low (1/cc) to permit sufficient growth for sedimentation. GRA

N79-22645# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Apr. - Jun. 1978
Jul. 1978 54 p refs Sponsored by DOE
(PB-290226/0; APL/JHU-EQR-78-2) Avail: NTIS HC A04/MF A01 CSCL 10A

The major tasks fall into the following categories: A study of geothermal energy applications in DOE-selected areas of the Atlantic Coastal Plain; regional operational research; the Low-head Hydroelectric Program; the Community Annual Storage Energy System; the status of a development plan for a low-cost flywheel; a landfill methane symposium; and a liquid natural gas safety study. GRA

N79-22646# General Accounting Office, Washington, D. C. Energy and Minerals Div.
TRANSPORTATION ENERGY CONSERVATION IN THE FEDERAL GOVERNMENT
Jan. 1979 15 p
(PB-291697/1; EMD-79-3) Avail: NTIS HC A02/MF A01 CSCL 10A

As part of a continuing effort to evaluate what the Federal Government is doing to manage its use of energy, the Department of Energy's (DOE's) efforts under the Federal Energy Management Program (FEMP) are reviewed. It is recommended that DOE, through the FEMP, take a more active leadership role in the transportation area by (1) issuing guidance to agencies, (2) investigating and promoting known transportation energy conservation opportunities, and (3) developing a better means of monitoring and evaluating agency energy conservation activities. GRA

N79-22647# General Accounting Office, Washington, D. C. Energy and Minerals Div.
MORE USE SHOULD BE MADE OF ENERGY-SAVING PRODUCTS IN FEDERAL BUILDINGS
Jan. 1979 26 p
(PB-291692/2; EMD-79-11) Avail: NTIS HC A03/MF A01 CSCL 10A

The many facets of the Federal Energy Management Program are evaluated. The use of available energy-saving technology and several areas where the program could be improved through more effective management are discussed. GRA

N79-22648# Tulsa Univ., Okla. Geophysics Lab.
GEOTHERMAL GROUND NOISE MEASUREMENTS AT ROOSEVELT HOT SPRINGS AND COVE FORT, UTAH Final Report, 1 Jan. 1976 - 31 Aug. 1978
Stanley J. Laster and Edward J. Douze Sep. 1978 96 p refs Sponsored in part by DOE
(Grant NSF AER-75-04819)
(PB-291624/5; Contrib-21; NSF/RA-780379) Avail: NTIS HC A05/MF A01 CSCL 08I

A study to determine the type of noise found around a geothermal reservoir is described. The investigation is based on the fact that noise sources, such as those produced by the reservoir and those that are culture or weather related, can be distinguished by identifying the type of waves produced. Frequency wavenumber spectra with the associated spectra and coherences was the main analysis technique used. Time domain detection methods were also employed in an attempt to find P-waves in the noise. Six element arrays, consisting of six seismometers, were used at both the Roosevelt Hot Springs and Cove Fort areas in Utah to determine the structure of the noise field and types of waves present. Field experiments, instrumentation, and the theory of array processing are described. Experimental results are presented for both geographical areas. Finally, the text presents conclusions, recommendations, references, and numerous tables and figures which include a seismic ground noise data chart, maps of the areas, and frequency-wavenumber spectra. GRA

N79-22649# NUS Corp., Rockville, Md.
HAZARDS IN NON-NUCLEAR POWER PLANTS Final Report
W. S. Roman, W. J. Israel, and R. F. Sacramo Jul. 1978 234 p refs Sponsored by Calif. Energy Commission.
(PB-290459/7; NUS-3099; CAEC-009) Avail: NTIS HC A11/MF A01 CSCL 10B

The health and safety hazards to the general public of coal-fired, oil-fired steam turbine, combined cycle, combustion (gas) turbine, and geothermal power plants are described. Hazardous events and conditions for normal and abnormal plant operations are identified and classified. Highest hazard ratings for normal plant conditions are given to air pollutants from the combustion cycle and to hydrogen sulfide emissions from geothermal plants; low ratings went to water pollution, cooling tower effects and noise. Abnormal plant occurrences such as fires and chlorine releases received relatively low scores in the overall risk assessment. GRA

N79-22650# Nuclear Services Corp., Campbell, Calif.
ASSESSMENT OF QUALITY ASSURANCE IN NON-NUCLEAR POWER PLANTS Final Report
Jack Weber Jul. 1978 104 p Sponsored by California Energy Commission
(PB-289842/7; CAEC-008) Avail: NTIS HC A06/MF A01 CSCL 10B

The effectiveness is examined of current management controls used to ensure that design intent is met for equipment used by California utilities in non-nuclear power plants. Seven possible quality assurance programs are discussed, and a recommended

program is presented. Check-sheets containing questions about management controls were used during interviews with the management of each of the five major California utilities, and during visits to five operating power plants. Among the management controls examined were: personnel training, instructions from management, information flow, records maintenance, verification testing, equipment storage, and review of controls to measure their effectiveness. Each control was examined for four organization levels; upper management, engineering, construction, and operations. All the utilities had some managerial controls implemented effectively, but none of the utilities had all the controls in operation. A quality assurance program that the California Energy Commission should require for future power plant projects is outlined. Quantitative cost-benefit studies are recommended before implementing any quality assurance program. GRA

N79-22163*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTERIZED SIMULATION AND PARAMETERIZATION OF A NEW HIGH-PERFORMANCE TUBULAR SOLAR COLLECTOR
F. L. Lansing and C. S. Yung *In its* The Deep Space Network 15 Apr. 1979 p 161-180 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-22651# Old Dominion Univ. Research Foundation, Norfolk, Va.
HABITAT DEVELOPMENT FIELD INVESTIGATIONS WINDMILL POINT MARSH DEVELOPMENT SITE JAMES RIVER, VIRGINIA. APPENDIX F: ENVIRONMENTAL IMPACTS OF MARSH DEVELOPMENT WITH DREDGED MATERIAL: SEDIMENT AND WATER QUALITY. VOLUME 1: CHARACTERISTICS OF CHANNEL SEDIMENTS BEFORE DREDGING AND EFFLUENT QUALITY DURING AND SHORTLY AFTER MARSH HABITAT DEVELOPMENT Final Report
Donald D. Adams (Wright State Univ.) and Dennis A. Darby Aug. 1978 85 p refs
(Contracts DACW65-75-C-0051; DACW65-76-C-0039)
(AD-A061917; D-77-23-App-F-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 13/2

The results of chemical and sedimentological studies conducted at a dredged materials marsh development site are presented. Navigation channel sediments were collected in January 1975, before dredging and marsh development, and described according to their temperature, pH, oxidation reduction potential, percent water, percent volatile solids, particle size composition, mineralogy, and cation exchange capacity. Sediment interstitial water and total sediment concentrations of sulfides and various nutrients and metals were documented. The relationships between channel sediment characteristics and the chemicals quality of effluent leaving the diked marsh development site were studied under three different conditions: (1) in January, 1975--during actual dredged material disposal for marsh substrate development, (2) during dewatering (2-4 days after the completion of dredged materials disposal operations), (3) in May 1975-3.5 months after dredging, before the beginning of marsh vegetation planting operations has begun or any extensive natural vegetation development had occurred. S.E.S.

N79-22652# California Univ., Bodega Bay. Marine Lab.
EFFECTS OF SUSPENDED DREDGED MATERIAL ON AQUATIC ANIMALS Final Report
Richard K. Peddicord and Victor A. McFarland Jul. 1978 120 p refs Sponsored by the Army
(AD-A058489; TR-D-78-29) Avail: NTIS HC A06/MF A01 CSCL 13/2

The impact of suspension of relatively uncontaminated and contaminated harbor sediments on juvenile and adult marine, estuarine and freshwater fish and invertebrates is reported. Studies of survival and tissue accumulation of contaminants were conducted for 21 days exposure to suspended sediments in a flow-through aquarium system. Even the most sensitive fish survived days of continuous exposure to suspensions of relatively uncontaminated sediment on the order of grams per liter and the invertebrates generally survived similar exposures to tens of grams per liter of relatively uncontaminated sediment. Exposure to suspensions of contaminated sediment decreased survival substantially, but, even so, mortality occurred only after exposure to higher concentrations for longer time periods than are created in the water column by the typical dredging operation. Tissue uptake of contaminants from suspensions of highly contaminated sediment was limited. Of 100 species-salinity-contaminant combinations where uptake were measured, it actually occurred in less than one fourth of the cases. Author

N79-22653# General Research Corp., McLean, Va.
DREDGED MATERIAL TRANSPORT SYSTEMS FOR INLAND DISPOSAL AND/OR PRODUCTIVE USE CONCEPTS Final Report
Paul S. Souder, Jr., Leo Tobias, J. F. Imperial, and Frances C. Mushal Jun. 1978 319 p refs
(Contract DACW39-76-C-0026)
(TR-D-78-28) Avail: NTIS HC A14/MF A01

Transport systems applicable for the movement of dredged material inland are identified and evaluated. Considerable detail from both a technical and economical point of view is provided to allow the users to apply the information to their particular situations. Five basic transportation modes were examined; pipeline slurry, rail haul, barge movement, truck haul, and belt conveyor movement. With regard to the pipeline slurry analysis, two pumping methods were analyzed, centrifugal pumping systems and Pneuma pumping systems. G.Y.

N79-22654*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OZONE MEASUREMENT SYSTEM FOR NASA GLOBAL AIR SAMPLING PROGRAM
Marvin W. Tiefermann May 1979 21 p refs
(NASA-TP-1451; E-9829) Avail: NTIS HC A02/MF A01 CSCL 13B

The ozone measurement system used in the NASA Global Air Sampling Program is described. The system uses a commercially available ozone concentration monitor that was modified and repackaged so as to operate unattended in an aircraft environment. The modifications required for aircraft use are described along with the calibration techniques, the measurement of ozone loss in the sample lines, and the operating procedures that were developed for use in the program. Based on calibrations with JPL's 5-meter ultraviolet photometer, all previously published GASP ozone data are biased high by 9 percent. A system error analysis showed that the total system measurement random error is from 3 to 8 percent of reading (depending on the pump diaphragm material) or 3 ppbv, whichever are greater. Author

N79-22655# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
ULTRAVIOLET-OZONE AND ULTRAVIOLET-OXIDANT TREATMENT OF PINK WATER
Milton Roth and Joseph M. Murphy, Jr. Nov. 1978 45 p refs
(Contract EPA-D6-0059)
(AD-A064106; AD-E400263; ARLCD-TR-78057) Avail: NTIS HC A03/MF A01 CSCL 13/2

Pink water, a solution of trinitrotoluene (TNT and other nitro-bodies) is a major pollutant at AAP's which manufacture TNT and load, assemble and pack bombs and other ammunition. Two of the new technologies being investigated as alternatives to carbon adsorption, which is currently used to purify pink water, are covered in this report. One method involves the use of ultraviolet (UV) ozone; the other, UV-oxidant. In the UV-ozone study, a pilot system with a volume of 3.79 cubic meters per day was evaluated. This system reduced dissolved TNT and RDX to less than one milligram per liter with no by-products requiring disposal. A larger, 18.9 cubic meter per day plant, is proposed. In evaluating the UV-oxidant process, commercially available UV-light, water-purification units were used in conjunction with oxidants such as hydrogen peroxide or oxone, a blend of potassium

persulfate oxidants. Variables such as film depth, dilutions, UV wavelength, and operation of the units in series rather than in parallel, were examined in optimizing the system. Author (GRA)

N79-22656# California Univ., Irvine. Water Resources Lab.
ENVIRONMENTAL QUALITY RESEARCH. USE OF UNICELLULAR ALGAE FOR EVALUATION OF POTENTIAL AQUATIC CONTAMINANTS Annual Report, 1 Jun. 1977 - 31 May 1978
Jan Scherfig, Peter S. Dixon, and Carol A. Justice Wright-Patterson AFB, Ohio AMRL Nov. 1978 32 p refs
(Contract F33615-76-C-5005; AF Proj. 6302)
(AD-A064154; AMRL-TR-78-86; AR-3) Avail: NTIS HC A03/MF A01 CSCL 13/2

Selenastrum capricorntum and Dunaliella tertiolecta were used as test algae in bioassays to determine the toxic and/or biostimulating effects of hydrazine and methylated hydrazines in various freshwater and marine aquatic environments. Standard batch algal assay procedures were used to determine safe concentrations and effective concentrations for the compounds studied. Chemical analyses were performed to determine compound stability under the various test conditions.
Author (GRA)

N79-22657# Air Force Academy, Colo. Frank J. Seiler Research Lab.
AN ANALYSIS OF AIRBORNE PARTICULATE LEVEL REDUCTION RESULTING FROM PAVING OF GRAVEL ROADS Technical Report, 1 Jul. - 15 Nov. 1978
Elroy A. Flom and Stephens J. Thompson May 1978 23 p refs
(AD-A063753; FJSRL-TR-78-0012) Avail: NTIS HC A02/MF A01 CSCL 13/2

Gravel utilized as surfacing material for secondary roads in El Paso County, Colorado contains microscopic particulates. The particulates, agitated into an airborne state by automobiles, represent a potentially hazardous air pollutant to the public. The airborne particulate level observed as a result of paving Ehrich Street, Colorado Springs, Colorado was reduced 1700 times by weight. The remaining airborned particulate matter is believed to be carried to the Ehrich Street area by mountain winds from Rampart Range. Author (GRA)

N79-22658# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla. Detachment 1 DTC.
STUDIES ON EVAPORATION OF HYDRAZINE AND PROCEDURES FOR CLEANUP OF SMALL SPILLS Final Report, Jun. 1977 - Jul. 1978
Thomas B. Stauffer and Arland W. Eyl, Jr. Aug. 1978 49 p refs
(AD-A064675; CEEDO-TR-78-12) Avail: NTIS HC A03/MF A01 CSCL 07/3

The evaporation rates of hydrazine (N2H4) from pools of the neat fuel and from aqueous solutions were measured under various environmental conditions. Hydrazine continues to evaporate for long periods of time (several days) even from solutions as dilute as 25-percent N2H4. Solutions of hydrazine appear to absorb carbon dioxide from the atmosphere. Carbon dioxide gas also suppresses evaporation of hydrazine from concrete surfaces. Procedures are outlined for cleanup and decontamination of small spills of hydrazine in the flightline area. Calcium hypochlorite (HTH), sodium hypochlorite solution (household bleach), and hydrogen peroxide with copper catalyst were evaluated for use as possible oxidants to treat dilute hydrazine solutions. Although all three give satisfactory results, either HTH or household bleach is recommended because of availability and ease of use. Author (GRA)

N79-22659# Missouri Univ. - Columbia. Dept. of Civil Engineering.
COMPUTER MODEL FOR PREDICTING POLLUTION IN THE MISSOURI Completion Report, 1 Oct. 1977 - 30 Sep. 1978
Henry Liu and Hune-Darh Cheng 15 Nov. 1978 105 p refs
(Contract DI-14-34-0001-8027; OWRT Proj. A-103-MO(2))
(PB-289392/3; W79-01905) Avail: NTIS HC A06/MF A01 CSCL 08H

Whenever there is an accidental spill of hazardous chemicals or radioactive materials into any river, it is vitally important to be able to issue an immediate forecast of the arrival time and peak concentration of a pollutant at each downstream city, to enable water users downstream to take effective precaution measures. Adequate forecast of this type was not possible in the past because of the lack of a proper model to predict one-dimensional dispersion in natural streams. The development of an improved model is reported. The new model is a modified Fickian model which uses a time-dependent dispersion coefficient, a timescale much greater than the Fischer time-scale, and a Pearson-Type-III distribution of concentration. GRA

N79-22660# Radian Corp., Austin, Tex.
IMPACT OF POINT SOURCE CONTROL STRATEGIES ON NO2 LEVELS Final Task Report, Mar. 1977 - Oct. 1978
B. R. Eppright, E. P. Hamilton, M. A. Haecker, and Carl-Heinz Michelis Nov. 1978 200 p refs
(Contract EPA-68-02-2608)
(PB-289498/8; EPA-600/7-78-212) Avail: NTIS HC A09/MF A01 CSCL 13B

The report gives final results of a study of the effect of two point source NOx control strategies in the Chicago Air Quality Control Region (AQCR): Combustion modification and flue gas treatment. The study involved the dispersion modeling of essentially all point and area sources of NOx in the AQCR. Gaussian type dispersion models were used for nonreactive pollutants. The model results were adjusted empirically for atmospheric conversion of NO to NO2. Two averaging times were considered: annual, corresponding to the present National Ambient Air Quality Standard (NAAQS) for NO2; and 1-hour, corresponding to the anticipated new short-term NAAQS for NO2. Results of the annual modeling indicate that large point sources are not major contributors to annual average NO2 levels. However, results of the short-term modeling include that large point sources can be important contributors to 1-hour average NO2 levels under certain meteorological conditions. Therefore, the control of large point source emissions can result in significant improvements in short-term NO2 air quality. GRA

N79-22661# Aerospace Corp., El Segundo, Calif. Energy and Resources Div.
COMBUSTION MODIFICATION EFFECTS ON NOx EMISSIONS FROM GAS-, OIL-, AND COAL-FIRED UTILITY BOILERS Final Report, Jul. 1976 - Aug. 1978
Owen W. Dykema Dec. 1978 99 p refs
(Grant EPA-R-803283-03)
(PB-289878/1; EPA-600/2-78-217) Avail: NTIS HC A05/MF A01 CSCL 13A

The overall objective of the study was to develop from this data: (1) further understanding of the effects of combustion modifications on combustion, and the resulting effects on NOx emissions; and (2) directly applicable guidelines for the application of combustion modification teccniques for the control of NOx emissions in full-scale operating utility boilers. The report includes: (1) discussion of modeling techniques used to analyze the data; (2) conclusions relative to the sources of NOx within the furnace; (3) guidelines for NOx reduction; and (4) an example application of the guidelines. Boiler firing types include single-wall, opposed and tangential configurations. It is included that NOx emissions are generated, in varying degrees, from conversion of fuel-bound nitrogen (the predominant source), heterogeneous combustion and mixing zone, second-stage mixing zone, and active burner region. Maintaining very fuel-rich initial combustion conditions, holding the initial peak combustion temperature to less than 2050 K, and delaying fuel gasification and mixing until the gas has been cooled somewhat should reduce NOx emissions from all four main sources. GRA

N79-22662# Washington Univ., Seattle. Center for Quantitative Science in Forestry, Fisheries, and Wildlife
ASSESSING THE IMPACT OF NUCLEAR-POWER PLANTS ON THE ENVIRONMENT Annual Progress Report
Douglas G. Chapman, Dennis P. Lettenmaier, Allyn H. Seymour, Gordon L. Swartzman, and Hannah E. Lawson Feb. 1979 184 p refs
(PB-290858/0; NUREG-CR-0552; APR-2) Avail: NTIS HC A09/MF A01 CSCL 06R

The wide-ranging effects that nuclear-power plants have on

the environment are assessed. These include: (1) mortality to fish and other organisms resulting from impingement and entrainment in the cooling system; (2) changes in behavioral and physiological characteristics of aquatic animals by higher temperature present in the discharge plume; and (3) toxid effects of biocides, heavy metals and radionuclides released in the aquatic or atmospheric environment. GRA

N79-22663# National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
HEAVY METAL CONCENTRATIONS AT THE APEX OF THE NEW YORK BIGHT
James E. Alexander (Marine Sci. Consortium, Inc.), Rudolph Hollman (Marine Sci. Consortium, Inc.), and Theodore White (Marine Sci. Consortium, Inc.) Dec. 1978 38 p refs
(PB-292615/2; NOAA-TM-ERL-MESA-34; NOAA-79021405) Avail: NTIS HC A03/MF A01 CSCL 13B

Particulate and total 'soluble' cadmium, cobalt, copper, iron, and lead, and total 'soluble' mercury concentration were determined for 146 seawater samples collected on November 8-9, 1973, in the apex of the New York Bight. With few exceptions, particulate lead, cadmium, cobalt, and nickel concentrations were below the limits of detection for the analytical scheme used. The concentrations of particulate iron and copper and total 'soluble' nickel varied as a function of tide and sample locations. Most of the iron was in the particulate form. GRA

N79-22664# Environmental Monitoring and Support Lab., Research Triangle Park, N. C. Quality Assurance Branch.
THE USE OF TEDLAR BAGS TO CONTAIN GASEOUS BENZENE SAMPLES AT SOURCE-LEVEL CONCENTRATIONS Final Report
Joseph E. Knoll, Wade H. Penny, and M. Rodney Midgett Sep. 1978 49 p refs
(PB-291569/2; EPA-600/4-78-057) Avail: NTIS HC A03/MF A01 CSCL 14B

The evaluated benzene samples remained essentially unchanged when held at ambient temperatures for up to 17 days, when cooled to -40C for one hour or when heated to 70C for one hour. At higher temperatures, some concentration changes were observed and above 105C decomposition of the bag seals resulted. At room temperature, there was no evidence of permeation loss and absorptive loss could only be observed upon prolonged contact. Flushing bags three times with nitrogen was sufficient to remove all traces of previous samples. Tedlar bags were used to prepare gaseous mixtures for calibration purposes in gas chromatography. GRA

N79-22665# Southern Research Inst., Birmingham, Ala.
EVALUATION OF THE PILLS 4 Final Report, May 1977 - Mar. 1978
William E. Farthing and Wallace B. Smith Jul. 1978 55 p refs
(Contract EPA-68-02-2131)
(PB-291430/7; SORI-EAS-78-611; EPA-600/7-78-130) Avail: NTIS HC A04/MF A01 CSCL 14B

Results are given of theoretical and experimental investigations of the operating characteristics of the PILLS IV (Particulate Instrumentation by Laser Light Scattering) in situ particle sizing instrument. Results of both investigations show large errors in sizing particles with the instrument. Attempts to correlate the experimental findings with qualitative theoretical explanations established a sensitivity to particle refractive index and detector response that seems to account for the observed characteristics. Further measurements would be required to test this explanation quantitatively. The prototype was designed to measure particle size using the ratio of intensities of light scattered from a particle at two small angles (14 and 7 degrees) with respect to an incident laser beam. The intensity ratio was chosen because of its relative independence of particle refractive index. However, the magnitude of the scattered intensity at 14 degrees is also used for several important decisions in the electronic processing logic which, for this particular optical system, render it especially sensitive to refractive index and detector variations for determinations of particle size distribution. Possible solutions to these problems were offered with only minor hardware changes. GRA

N79-22666# Illinois Inst. of Natural Resources, Chicago.
A HANDBOOK FOR THE ASSESSMENT OF ENVIRONMENTAL BENEFITS AND POLLUTION CONTROL COSTS Final Report
L. Babcock, K. Croke, A. Hurter, P. Loquercio, H. Roberts, H. Sievering, and G. Tolley Aug. 1978 174 p refs
(PB-291786/2; IINR-78/29) Avail: NTIS HC A08/MF A01 CSCL 13B

Assessment methods available to writers of economic impact studies are described. Contents include the legal basis of an Ecis (Economic impact statement), how to design an Ecis, environmental quality analysis (including environmental benefit/damage assessment and the impact of pollution on residential property values), pollution control: cost estimation, and prices, output and employment. GRA

N79-22667# Missouri Univ. - Columbia. Dept. of Civil Engineering.
POLLUTION FORECAST IN STREAMS M.S. Thesis
Hung-Darh Cheng Jul. 1978 104 p refs
(Contract DI-14-34-0001-8027)
(PB-291440/6; W79-02831; OWRT-A-103-MO(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

Pollution forecast for major rivers in the U.S. necessitates the use of a simple one-dimensional model of dispersion. The Fickian one-dimensional model does not adequately describe longitudinal dispersion in natural stream. A modified Fickian model is proposed herein which is able to describe dispersion in natural streams adequately. A procedure is suggested for using this modified Fickian model for pollution forecast in rivers such as the Missouri. GRA

N79-22668# Northrop Services, Inc., Research Triangle Park, N. C.
CONVENTIONAL COMBUSTION ON ENVIRONMENTAL ASSESSMENT PROGRAM
Pamela K. Lattimore Dec. 1978 17 p
(Contract EPA-68-02-2566)
(PB-291401/8; EPA-600/8-78-021) Avail: NTIS HC A02/MF A01 CSCL 13B

The objectives, methodology, development, and output of the conventional combustion environmental assessment program on the effect of pollutants from the combustion of fossil fuel is presented. GRA

N79-22669# Technology Service Corp., Santa Monica, Calif.
CHARACTERIZATION OF VEHICLE USE IN FINE AIR QUALITY CONTROL REGIONS
John A. Eldon and Donald B. Hunsaker Mar. 1978 94 p refs
(Contract EPA-68-03-2392)
(PB-291645/0; TSC-PD-A158) Avail: NTIS HC A05/MF A01 CSCL 13B

Data, estimates and projections were compiled of vehicle population and use by vehicle age and type, for each of these cities: Chicago, Denver, Los Angeles, Houston, and Phoenix. As motor vehicle emissions are sensitive to temperature, humidity, and barometric pressure, meteorological data were also compiled. GRA

N79-22670# Tennessee Univ., Knoxville.
AN ASSESSMENT OF THE EFFECTS OF STORMWATER RUNOFF FROM URBAN WATERSHEDS ON THE WATER QUALITY OF A RECEIVING RESERVOIR M.S. Thesis
Steve Neperud Mar. 1978 96 p refs Sponsored by Office of Water Research and Technology
(PB-291643/5; W79-03005; OWRT-A-043-TENN(3)) Avail: NTIS HC A05/MF A01 CSCL 13B

The purpose was to determine the effects of stormwater runoff on the water quality of Fort Loudoun Reservoir. The experimental data were obtained from samples taken from Fort Loudoun Reservoir before, during, and after runoff events as well as from samples taken during dry weather (control conditions). Water quality parameters obtained were dissolved oxygen, pH, biochemical oxygen demand, conductivity, temperature, total solids and fecal coliform bacteria. GRA

N79-22671# GCA Corp., Bedford, Mass. Technology Div.
INVENTORY DEVELOPMENT FOR EVALUATION OF

MEASURES FOR THE CONTROL OF NONTRADITIONAL SOURCES OF PARTICULATES IN SOUTHERN NEW ENGLAND Final Report
Fletcher G. Shives and Michael W. Kozenko Dec. 1978 104 p
(Contract EPA-68-02-2607)
(PB-291442/2; GCA-TR-78-47-G) Avail: NTIS HC A06/MF A01 CSCL 13B

This report presents detailed micro-inventories of traditional and nontraditional sources of particulate matter within 5 mile and 1 mile radii, respectively, of each of 10 sites in New England. The 10 sites are located in Bridgeport, Hartford, and Waterbury, Connecticut, Boston, Fall River, Springfield, and Worcester (two sites), Massachusetts; Bangor, Maine and Providence, Rhode Island. Emissions data for traditional sources (point and area) were obtained from the most recently available state inventories for the area of concern. The data reporting format is principally that of the micro-inventories for TSP draft report (T.G. Pace, U.S. EPA, Research Triangle Park, N.C.). The results of this study can be used in an evaluation of control measures, reductions in particulate matter emissions, and likely air quality improvements at the study sites. GRA

N79-22672# Little (Arthur D.), Inc., Cambridge, Mass.
THE ECONOMIC EFFECTS OF ENVIRONMENTAL REGULATIONS ON THE POLLUTION CONTROL Final Report
Terry W. Rothermel and Craig Lentz Sep. 1978 170 p
(Contract EPA-68-01-4660)
(PB-291134/5; ADL-C-80920FR; EPA-23/1-78-002) Avail: NTIS HC A08/MF A01 CSCL 05A

The recent history (1972-1976) of the PCI has been one of better than average growth and only average profitability. Leading companies in each PCI sector enjoyed growth rates in the range of 16-22% per year (versus 9% of all U.S. manufacturing). However, the level of profitability was only about average for all U.S. manufacturing or comparable industrial segments (e.g., 10-11% after-tax return on stockholders' equity). An important exception has been the water treatment chemicals segment which has been among the most profitable in American industry. In 1977, the markets for these pollution control products totalled $1.8 billion. These markets are projected to grow to $3.5 billion by 1983 or at a pace of 11-12% per year (in current dollars and assuming 5-7% inflation). Current employment by the PCI in association with these markets is estimated to be 35,850 jobs. Assuming that the amount of sales generated per employee will continue to increase as well, employment is projected to grow to 43,900 in 1983. GRA

N79-22673# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: OVERVIEW MATRIX FOR NATIONAL CRITERIA POLLUTANT EMISSIONS (1978) Final Report, Apr. - Jul. 1978
E. C. Eimutis, R. P. Quill, and G. M. Rinaldi Jul. 1978 77 p
(Contract EPA-68-02-1874)
(PB-291764/9; MRC-DA-796; EPA-600/2-78-004R) Avail: NTIS HC A05/MF A01 CSCL 13B

A list of stationary sources that emit criteria pollutants is reported. The overview matrix was prepared using a computerized data base established for emissions of air pollutants from approximately 800 stationary source types in the combustion, organic materials, inorganic materials, and open source categories. The matrix lists the total national emissions of criteria pollutants emitted by source type. (A source type is defined as a group of emission sources which have the same process and emission characteristics.) GRA

N79-22674# Drexel Univ., Philadelphia, Pa.
WATER QUALITY AND HEALTH SIGNIFICANCE OF BACTERIA INDICATORS OF POLLUTION
Wesley O. Pipes 1978 227 p refs Proc. of a Workshop held at Philadelphia, 17-18, Apr. 1978
(Grant NSF ENV-77-12114)
(PB-291605/4; NSF/RA-780349) Avail: NTIS HC A11/MF A01 CSCL 06F

The concepts basic to the use of bacterial indicators of pollution in the protection of public health and the regulation of water quality are examined. Subject areas covered include: waterborne diseases, fecal indicators, indicator-pathogen density relationships, indicators and water quality, enumeration and statistical inferences, and risks, regulators and resources. GRA

N79-22675# Kentucky Water Resources Research Inst., Lexington.
EMISSION OF MICROBIAL AEROSOLS FROM POLLUTED WATERS IN DENSELY POPULATED REGIONS
Lois S. Cronholm 1978 73 p refs
(Contract DI-14-34-0001-8019)
(PB-291947/0; RR-117; W79-03438; OWRT-A-068-KY(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

This air surrounding three activated sludge tanks was sampled over a two year period for the emission of bacterial aerosols under a variety of climatic conditions and at barying distances upwind and downwind of the aerated tanks. All plants emitted species of enteric bacteria which are significant as index organisms and as frank pathogens. The emission pattern of these bacteria were influenced by distance from the plant and wind direction. Distance from the source was the only reliable predictor of emissions. Multiple regression analysis revealed no consistent influences of any environmental factor or emission rate, but relative humidity, wind speed, air temperature, and ozone levels showed some contribution on the bacterial count. GRA

N79-22676# Washington State Water Research Center, Pullman.
SIGNIFICANCE OF TURBIDITY FOR QUALITY ASSESSMENT OF AGRICULTURAL RUNOFF AND IRRIGATIONAL RETURN FLOW Project Completion Report
Day L. Bassett and James M. Ebeling Dec. 1978 72 p refs
(Contract DI-14-34-0001-7102; OWRT Proj. A-091-WASH(1)) (PB-291730/0; W79-03006) Avail: NTIS HC A04/MF A01 CSCL 13B

Turbidity and suspended sediment concentration were measured for both agricultural runoff and irrigation return flow. Extensive statistical analysis showed only minimal correlation. Mie scattering theory was explored to determine the significance of such factors as particle size, index of refraction, concentration, and angle of scatter for both the nephelometer and the transmissiometer. It was found that only particles of less than ten microns in diameter contribute significantly to the measurement of turbidity. GRA

N79-22677# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: NONCRITERIA POLLUTANT EMISSIONS, 1978 UPDATE Final Report, Apr. 1978 - Jul. 1978
E. C. Eimutis, R. P. Quill, and G. M. Rinaldi Jul. 1978 152 p refs
(Contract EPA-68-02-1874)
(PB-291747/4; MRC-DA-798; EPA-600/2-78-004T) Avail: NTIS HC A09/MF A01 CSCL 13B

Stationary sources are listed that emit each of 389 noncriteria pollutants quantities of such emissions are indicated. The list was prepared using a computerized data base established for emissions of air pollutants from approximately 800 stationary source types in the combustion, organic materials, inorganic materials, and open source categories. A source type is defined as a group of emission sources which have the same process and emission characteristics. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N79-22678 State Univ. of New York at Stony Brook.
ENERGY BALANCE CLIMATE MODELS AND CLIMATE SENSITIVITY Ph.D. Thesis
Ming-Shih Lian 1978 129 p
Avail: Univ. Microfilms Order No. 7907566

The empirical relationship between zonal albedo and temperature was reexamined and incorporated in an annually and zonally averaged energy balance climate model. It was concluded that ice-albedo feedback constitutes a relatively mild climate feedback

mechanism, amplifying global climate sensitivity by roughly 25%. An equivalent seasonal model was developed to test the results of the climate sensitivity experiments. The ability of the present seasonal model to simulate satisfactorily the observed annual cycle of zonal surface temperature confirms the validity of the present climate modeling in evaluating the climate sensitivity due to external perturbations. In addition the seasonal model indicates a significant seasonal variation at high latitudes for the change in zonal surface temperature due to changing solar constant. Dissert. Abstr.

N79-22679* National Aeronautics and Space Administration. Pasadena Office, Calif.

SEISMIC VIBRATION SOURCE Patent

Warren L. Dowler (JPL), Giulio Varsi (JPL), and Lien C. Yang, inventors (to NASA) (JPL) Issued 10 Apr. 1979 4 p Filed 22 Aug. 1977 Sponsored by NASA
(NASA-Case-NPO-14112-1; US-Patent-4,148,375; US-Patent-Appl-SN-826326; US-Patent-Class-181-117; US-Patent-Class-181-106; US-Patent-Class-102-21.6; US-Patent-Class-175-1; US-Patent-Class-166-63) Avail: US Patent and Trademark Office CSCL 08K

A system for vibrating the earth in a location where seismic mapping is to take place is described. A relatively shallow hole formed in the earth, such as a hole 10 feet deep, placing a solid propellant in the hole, sealing a portion of the hole above the solid propellant with a device that can rapidly open and close to allow a repeatedly interrupted escape of gas. The propellant is ignited so that high pressure gas is created which escapes in pulses to vibrate the earth.

Official Gazette of the U.S. Patent and Trademark Office

N79-22680*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

CHEMICAL KINETIC AND PHOTOCHEMICAL DATA FOR USE IN STRATOSPHERIC MODELLING

W. B. DeMore, L. J. Stief (NASA Goddard Space Flight Center), F. Kaufman (Pittsburgh, Univ.), D. M. Golden (SRI International), R. F. Hampton (NBS), M. J. Kurylo (NBS), J. J. Margitan (Michigan Univ.), M. J. Molina (California Univ., Irvine), and R. T. Watson 15 Apr. 1979 132 p refs
(Contract NAS7-100)
(NASA-CR-158514; JPL-PUB-79-27) Avail: NTIS HC A07/MF A01 CSCL 04A

An evaluated set of rate constants and photochemical cross sections were compiled for use in modelling stratospheric processes. The data are primarily relevant to the ozone layer, and its possible perturbation by anthropogenic activities. The evaluation is current to, approximately, January, 1979. G.Y.

N79-22681# ENSCO, Inc., Springfield, Va.

IMPROVED PROCEDURES FOR DETERMINING SEISMIC SOURCE DEPTHS FROM DEPTH PHASE INFORMATION Final Report

Richard T. Houck and Edward A. Page Oct. 1978 30 p
(Contract F08606-77-C-0007; ARPA Order 2551)
(AD-A064686) Avail: NTIS HC A03/MF A01 CSCL 08/11

This work has been directed towards evaluating the utility of ENSCO's teleseismic source depth determination procedure as a nuclear discriminant, and also towards simplifying interpretation of the program output. This depth determination procedure, developed during four previous ARPA-sponsored projects, uses cepstrum analysis techniques to detect depth phases, converts delay times to depths using computed travel times, and combines results from different primary phases (P,PP,PPP,PcP) and stations to get a single depth estimate for an event. Thus, this technique automatically makes use of all available depth phase information in arriving at an estimated depth. Most events were analyzed using the unclassified discrimination experiment data set. This data had very sparse station coverage for almost all events, and it was concluded that this depth determination procedure is not suitable for such a data set. A total of 41 events were examined, but only 18 depth estimates could be made, and most of these were unreliable due to poor station coverage. Some analysis was also done using the complete discrimination experiment data set. This has much better coverage and promises to produce better results. GRA

N79-22682# Ghana Univ., Legon. Dept. of Physics.

PHASE AND AMPLITUDE SCINTILLATION AT THE EQUATOR Final Scientific Report, 1 Feb. 1978 - 31 Oct. 1978

John R. Koster 31 Oct. 1978 57 p ref
(Grant AF-AFOSR-3516-78; AF Proj. 4643)
(AD-A063824; AFGL-TR-78-0298) Avail: NTIS HC A04/MF A01 CSCL 04/1

Chapter 1 describes some features of new and more accurate scintillation data at 257 MHz from a high elevation satellite (MARISAT 1). Observations at Legon yield improved results on depth of fading, fading as a function of elevation, and some initial results on fading as a function of frequency and longitude. These data are compared with earlier 136 MHz results from Legon. Chapter 2 describes the phase switching system used for making the above satellite signal amplitude measurements. Chapter 3 gives a description, with circuit diagrams, of a polarimeter used at Legon for both digital and analogue Faraday measurements. Author (GRA)

N79-22683*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

IONOSPHERE RESEARCH

30 Sep. 1978 55 p refs
(Contracts NAS6-2826; N00014-77-C-0041; Grants NGL-39-009-003; NGR-39-009-032; NsG-6004; NsG-5212; NsG-7350; DAAG29-78-G-0129; NSF ATM-76-03144-A01; NSF ATM-76-14277-A01; et al)
(NASA-CR-158512; AD-A064153; PSU-IRL-SAR-78-2; SATR-2) Avail: NTIS HC A04/MF A01 CSCL 04/1

Contents: Planetary Atmospheres; E and F Region; D-Region; Mass Spectrometer Measurements; Direct Measurements; Atmospheric Reactions; and Particle Collection and Ionosphere Composition Studies Using Rocket Borne Probes. GRA

N79-22684# Air Force Geophysics Lab., Hanscom AFB, Mass.

IONIC REACTIONS DEDUCED FROM ATMOSPHERE EXPLORER DATA: A SURVEY

William Swider 13 Nov. 1978 24 p
(AD-A063818; AFGL-TR-78-0274; AFGL-ERP-644) Avail: NTIS HC A02/MF A01 CSCL 04/1

In general, ionic reaction rate coefficients deduced from Atmosphere Explorer Satellite data are in good agreement with laboratory results. Rate coefficients have been ascertained for a few processes which are not available from laboratory work. However, to date, the data base has yielded little new information pertinent to the needs of the DNA community. Author (GRA)

N79-22685# Lincoln Lab., Mass. Inst. of Tech., Lexington.

AUTOMATIC SKY QUALITY ASSESSMENT. 1: THE POINT MEASUREMENT DEVICE

John M. Sorvari 28 Nov. 1978 38 p refs
(Contract F19628-78-C-0002)
(AD-A064280; ETS-38; ESD-TR-78-293) Avail: NTIS HC A03/MF A01 CSCL 04/1

An automated photometer designed to measure atmospheric extinction and sky brightness has been implemented. The measurement routines are primarily under computer control and require a minimum of operator intervention. A description of the theory and operation of the system is given, and the text concludes with a discussion of the use of the automated system in the context of the GEODSS mission. Author (GRA)

N79-22686# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.

THE NORWEGIAN SEISMIC ARRAY (NORSAR), PHASE 3 Final Technical Summary, 1 Apr. - 30 Sep. 1978

D. Rieber-Mohn 31 Oct. 1978 78 p
(Contract F08606-78-C-0005; ARPA Order 2551)
(AD-A063923; NORSAR-SCIENTIFIC-1-78/79; NORSAR-CONTRIB-258) Avail: NTIS HC A05/MF A01 CSCL 08/11

This report describes the operation and research activities at the Norwegian Seismic Array (NORSAR) for the time period from 1 April to 30 September 1978. In general, the array operation is characterized as stable, with little change from the previous reporting period. There has been a slight improvement in the performance of the data recording and online detection processing

relative to the previous reporting period (uptime increased to 93.7% from 91.6%). The Special Processing System (SPS) is still the major cause of the breaks in operation (75 out of 139), the longest one lasting for more than 4 days. Statistics from short sample intervals indicate that the number of Online detections average about 200 per day with the present threshold setting, while the On-line Event Processor processes about 25 events per day for transmission to the SDAC. The average number of analyst-retrieved and accepted events has been 10.8 per day during the period. GRA

N79-22687# Naval Ocean Systems Center, San Diego, Calif.
EXACT RAY PATHS IN A MULTISEGMENT QUASIPARABOLIC IONOSPHERE. EQUATIONS FOR hF RAY PATHS AID IN DISPLAYING PROPAGATION CONDITIONS FOR REAL-TIME MINICOMPUTER-BASED ASSESSMENT SYSTEMS Technical Report, Jun. 1977 - Jul. 1978
J. R. Hill 15 Sep. 1978 24 p
(AD-A063994; NOSC/TR-300) Avail: NTIS HC A02/MF A01 CSCL 20/14

Exact ray path calculations in a multiple quasiparabolic layer ionosphere are derived for use in mini- and microcomputer-based propagation assessment systems. Ionospheric profiles are modeled by quasiparabolic layers of two forms: normal layers having electron density maxima and valley layers having a minimum. Ray fans are displayed, demonstrating implementation of the equations on a minicomputer (SEL 810A) and a microcomputer (Tektronix 4051). The microcomputer program (in BASIC) used to calculate the single-layer propagation is included.
Author (GRA)

N79-22688# Michigan Univ., Ann Arbor. Space Physics Research Lab.
AURORAL ELECTRON FLUXES Final Report, 1 Apr. 1977 - 1 Feb. 1978
William E. Sharp Nov. 1978 20 p refs
(Grant AF-AFOSR-3320-77; AF Proj. 2310)
(AD-A064752; AFOSR-79-0037TR) Avail: NTIS HC A02/MF A01 CSCL 04/1

The data analyzed was from an auroral rocket probe, AF 10.312, launched in 1974 from Poker Flats, Alaska. The instrumentation is described in an AF Geophysics Laboratory Technical Report AFCRL-TR-75-0023. The data were from both a low energy and high energy electron spectrometer, which measured fluxes at 1-100 eV and 1-20 KeV respectively. The rocket flight was north along a geomagnetic meridian, crossing the Harang discontinuity and several non optical auroral arcs. Data represents the first available electron flux measurements over such an extensive energy range (1 eV to 20 KeV) at an instant of time and for a number of altitudes. The flux distribution to the south of the discontinuity showed two 'bumps', one at 5 eV and the other at 4 KeV due to a lack of loss mechanisms at the lower energy and by the monoenergetic flux from space for the higher. The fluxes generally decreased with decreasing altitude as expected. No pitch angle dependence was discovered. South of the discontinuity peak fluxes were centered on 2 KeV. An order of magnitude increase in flux at energies less than 10 KeV were measured while the discontinuity was crossed (rocket was at 165 Km). In the auroral arcs, the peak flux was at 7 KeV. Wave particle interactions were interpreted as the cause for the pattern of change with altitude of the greater than 1 KeV and less than 10 eV fluxes. Author (GRA)

N79-22689# Texas Instruments, Inc., Dallas. Equipment Group.
GEOPHYSICAL STUDIES FOR MISSILE BASING: SEISMIC RISK STUDIES IN THE WESTERN UNITED STATES Final Scientific Report, 1 Mar. - 31 Oct. 1978
James C. Battis 20 Dec. 1978 96 p refs
(Contract F44620-76-C-0063; AF Proj. 2309)
(AD-A064798; TI-ALEX(02)-FSR-78-01; AFOSR-79-0038TR) Avail: NTIS HC A05/MF A01 CSCL 08/11

Seismic risk studies were conducted for two military facilities in the western United States: Luke Air Force Base, Arizona, and the Nevada Test Site(NTS). Both facilities are potential sites for MX missile system installations. For each site, peak around motion risk curves, for annual risks ranging between values of 1.0 and 0.001, were estimated, based on seismicity characteristics of the risk regions surrounding each facility. Difficulties in evaluating the risk at NTS were caused by unannounced nuclear tests and induced seismic activity in the area of study. Composite design reponse spectra were generated for each site corresponding to various levels of annual risk to provide a representation of seismic risk in a form directly useful to the engineering community. Finally, the possible effects which might result from seismic activity on potenially active faults near each site were considered.
Author (GRA)

N79-22690# Ohio State Univ., Columbus. Dept. of Geodetic Science.
AN INVESTIGATION OF TWO MODELS FOR THE DEGREE VARIANCES OF GLOBAL COVARIANCE FUNCTIONS Interim Report
Christopher Jekeli Sep. 1978 80 p refs
(Contract F19628-76-C-0010; AF Proj. 7600)
(AD-A063198; DGS-275; AFGL-TR-78-0235; SR-18) Avail: NTIS HC A05/MF A01 CSCL 08/5

Degree variances of the covariance function for gravity anomalies are represented according to the two-component model suggested by Moritz in an attempt to arrive at a low horizontal gradient variance (200 E squared). The parameters of the model are determined through a least squares adjustment to data consisting of GEM 9 anomaly degree variances, as well as empirical point and mean anomaly variances. Results show that this model can accommodate the given point and mean anomaly variances and degree variances, while also yielding the desired low gradient variance. A comparison of this and a similar one-component model investigated by Tscherning and Rapp indicates that the latter cannot produce a low gradient variance together with a satisfactory fit to the data. Also, it does not adapt as well to the observed (GEM 9) attenuation of the anomaly degree variances. Author (GRA)

N79-22691# Utah State Univ., Logan. Center for Atmospheric and Space Sciences.
STUDIES OF THE DYNAMICS OF THE HIGH LATITUDE IONOSPHERE Final Report, 11 Nov. 1976 - 30 Sep. 1978
W. J. Raitt 26 Oct. 1978 89 p refs
(Contract F19628-77-C-0011)
(AD-A064530; AFGL-TR-78-0261) Avail: NTIS HC A05/MF A01 CSCL 04/1

The report surveys theoretical and experimental studies of ionospheric dynamics made during the contract period. Two major aspects of this topic were studied; the outflow of He(+) from the earth's ionosphere, and the effect of magnetospheric convection on the high latitude ionosphere. Model programs were written to study the general characteristics of the outflow of He(+) and also to make quantitative estimates of the escape flux of this ion. An existing model program for studying the effect of convection electric field on the F+region was updated and the N(+) ion was included in the model. Initial work was started to incorporate realistic convection trajectories in the model program. Experimental data from the S3-2 satellite was used to compare with theoretical predictions of both the variation of plasma density with perpendicular electric field and the onset of light ion outflow at high latitudes. While the light ion outflow showed good agreement with theory, the effects of perpendicular electric fields did not and provided further stimulus to incorporate the effect of convection trajectories in our ionospheric models.
Author (GRA)

N79-22692# Computer Corp. of America, Cambridge, Mass.
SIP ACCOMMODATION OF ADDITIONAL SEISMIC DATA SITES
Donald E. Eastlake, III 29 Jan. 1979 19 p refs
(Contract N00039-78-C-0246; ARPA Order 3540)
(AD-A064988; CCA-79-08) Avail: NTIS HC A02/MF A01 CSCL 08/11

The SIP is a dedicated minicomputer communications system developed and operated by Computer Corporation of America. It interfaces a real time seismic information network to the Datacomputer (DORIN and EASTLAKE). The Datacomputer is a network data utility designed to support very large databases and shared access by remote heterogeneous computers (MARTLL and STERN). It is the only operational general purpose database

system capable of handling datasets in excess of a trillion bits (CCA). GRA

N79-22693# Office of Science and Technology, Washington, D. C.
THE NATIONAL EARTHQUAKE HAZARDS REDUCTION PROGRAM
1978 32 p
(PB-291311/9) Avail: NTIS HC A03/MF A01 CSCL 05A

The scope, limits and purpose are outlined for the National Earthquake Hazards Reduction Program formulated from the passage of the Earthquake Hazards Reduction Act of 1977. The bill charges the president with establishing such a program with both long and short run objectives. A reduction program is outlined, aimed at reducing the disaster potentialities and realities from earthquakes. The thesis centers around the conclusion that the proper balance between cost-effective hazard reduction programs and reconstruction relief must be ascertained so as to mitigate both the tragedy from the disaster and the unnecessary costs from poor planning. GRA

N79-22694# Radian Corp., Austin, Tex.
STATISTICAL ANALYSIS OF FACTORS INFLUENCING OZONE CONCENTRATIONS IN SOUTHERN LOUISIANA
Hugh J. Williamson and Otto M. Friedrich Sep. 1978 83 p refs
(Contract EPA-68-02-1383)
(PB-291842/3; EPA-906/9-78-002C) Avail: NTIS HC A05/MF A01 CSCL 04A

A statistical analysis of ozone concentrations in southern Louisiana is presented. The data used were collected at nine monitoring sites during a three-month period, July 17 - October 17, in 1976. The factors which accompany high levels of ozone concentration and the observed relationships are described. The variables which influence the amount of ozone are discussed. The relationships between ozone concentration and a number of meteorological and spatial variables are explored. The relationships between ozone concentration and the concentrations of other pollutants are discussed. GRA

N79-22695# Radian Corp., Austin, Tex.
RELATIONSHIP OF METEOROLOGY TO SUMMER OZONE IN SOUTHERN LOUISIANA
David L. Harper Sep. 1978 53 p refs
(Contract EPA-68-02-1383)
(PB-290454/8; RAD-TN-100-195; EPA-906/9-78-002B) Avail: NTIS HC A04/MF A01 CSCL 13B

Continuous ozone data obtained at nine sites across southern Louisiana showed that the ozone levels frequently exceeded the federal standard of 80 parts per billion during the three month study period. The days with ozone over the standard were generally characterized as having light winds, abundant sunshine, and high temperatures. Intermittent periods of region wide low ozone were primarily associated with widespread thunderstorm activity. The cold fronts which passed through southern Louisiana during the study period were conducive to nighttime ozone levels which were higher than nighttime levels typically observed during the study period. GRA

N79-22696# National Committee for Rock Mechanics, Washington, D. C.
U S NATIONAL COMMITTEE FOR ROCK MECHANICS Summary Report, 1977
1978 40 p refs
(Grant NSF ISP-77-13297)
(PB-291017/2; NSF/RA-780334) Avail: NTIS HC A03/MF A01 CSCL 08G

The U.S. National Committee for Rock Mechanics, in the Assembly of Mathematical and Physical Sciences of the National Research Council, has served United Stated scientists and engineers concerned with rock-mechanics problems since 1967. This fourth periodic report for 1977 describes the work of the Committee and its Panels for calendar year 1977. The activities of the two Panels concerned with educational requirements and domestic/international activities are summarized. The last section of this report presents the findings and recommendations of the following three technical-study Panels, which were organized early in 1976 and completed their studies and reports in 1977: the Panel on Rock Mechanics Problems That limit Energy Resources Recovery and Development; the Panel on Rock Mechanics Problems Related to Underground Construction and Tunneling; and the Panel on Rock Mechanics Problems Related to Seismology and Earthquake Engineering. GRA

N79-22697# Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
SOIL MORPHOLOGIC AND HYDRAULIC CHANGES ASSOCIATED WITH WASTEWATER IRRIGATION Research Project Technical Completion Report, 1 Jul. 1975 - 31 Dec. 1978
T. W. Simpson and R. L. Cunningham Nov. 1978 212 p refs
(Contract DI-14-34-0001-8040)
(PB-291399/4; W79-02817; OWRT-A-045-PA(1)) Avail: NTIS HC A10/MF A01 CSCL 08M

Fifteen topographically matched pit transects were examined in treatment areas. Detailed profile descriptions and sketches were prepared for each transect. The morphologic data were quantified using a relative morphology rating scale developed to show differences in morphologic properties that could be related to hydraulic properties that had been significantly altered due to wastewater irrigation. This total score was used to establish suitability levels for sites based on the scores from the relative profile rating scale. Potential longevity of the site for wastewater irrigation was estimated using the average annual percentage of decrease in the relative profile rating score for all treatments, assuming a linear rate of change. U.S. EPA (1975) guidelines were used to make decisions on suitability using morphologic criteria. Morphologic properties such as mottling, soil structure and moist consistence have changed due to wastewater irrigation. The 118 and 231 cm per year treatment areas have been altered sufficiently so they are not suitable for irrigation. The 59 cm per year area was considered marginally suitable for continued wastewater irrigation. GRA

N79-22698# Purdue Univ., Lafayette, Ind. Joint Highway Research Project.
SOIL COMPACTION SPECIFICATION PROCEDURE FOR DESIRED FIELD STRENGTH RESPONSE Interim Report
John T. Price Jun. 1978 168 p refs Prepared in cooperation with Indiana State Highway Comm. and FHA
(PB-291805/0; JHRP-78-7; IR-4) Avail: NTIS HC A08/MF A01 CSCL 08M

A glacial silty clay was compacted in a field test pad to determine what variables control density and strength and their variabilities. Correlation was attempted to provide a prediction process for the field result. A procedure was identified by which quality assurance and design engineers can interpret and write compaction specifications that insure a desired field strength. Strength is controlled by water content, density, and incompactive effort. Dry density is controlled by water content, compactive effort, and the interaction between them. The quantitative influence of each constituent variable varied with type of equipment. Variabilities of both density and strength are significant. A procedure is presented for this soil which develops a computer tabulation of the variables to allow an estimate of field compacted strength knowing inspection test results. A procedure to allow the design engineer to directly determine his compaction specification to insure a desired strength and its variability is developed. GRA

N79-22699# Arizona Univ., Tucson. Dept. of Geosciences.
GRAVITY ANALYSIS OF THE SUBSURFACE STRUCTURE OF THE UPPER SANTA CRUZ VALLEY, SANTA CRUZ COUNTY, ARIZONA M.S. Thesis
Robert Wade Parker 1978 152 p refs
(Contracts DI-14-34-0001-7005; DI-14-34-0001-7006; OWRT Proj. A-078-ARIZ(2))
(PB-291919/9; W79-03002) Avail: NTIS HC A08/MF A01 CSCL 08E

A gravity survey was conducted in the Upper Santa Cruz Valley, Santa Cruz County, Arizona. Residual gravity anomalies were interpreted to define the subsurface structure and to estimate the water resource potential. A north-south trending fault system with at least 2000 ft of vertical displacement forms the western half of the basin graben structure. The eastern basin boundary is a combination of northwest- and northeast-trending scarps.

These scarps are all extensions of or parallel to inferred surface faulty traces. The valley is divided into three major sections, each having a maximum thickness of 4200 ft of alluvium. Alluvium-covered pediments are present on both sides of the valley. The total volume of ground water available in storage in the Upper Santa Cruz Valley is calculated to be 24.3 million acre feet. This total volume of water is not entirely recoverable, because of permeability factors. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-22700 California Univ., Los Angeles.
A METHOD FOR OBTAINING MORE CLIMATOLOGICAL INFORMATION FROM SHORT OBSERVATIONAL RECORDS Ph.D. Thesis
John Garrett Williams 1978 160 p
Avail: Univ. Microfilms Order No. 7907695

A method was developed to increase the amount of climatic information obtained from observational records of climatic variables such as temperature, humidity, radiation, and wind that are only one or a few years long. The method relates the climatic variables at the observational site for each day of the record to the sea level and 500 mb atmospheric pressure fields over a large area surrounding the site. The climatic variables for days not in the record can then be estimated from the relatively long and reliable record of pressure data. The method relates conditions at the observational site to the pressure fields by assigning days to sets of circulation types, developed from eight years of pressure data by a SAHN centroid clustering technique; the short observational record provides estimates of mean conditions for the circulation types at the site. Dissert. Abstr.

N79-22701 Pennsylvania State Univ., University Park.
MEASUREMENT OF MICROMETEOROLOGICAL TEMPERATURE PROFILES BY THE INVERSION OF OPTICAL DATA Ph.D. Thesis
William Howard Mach 1978 115 p
Avail: Univ. Microfilms Order No. 7909099

Optical data containing the relative positions of an observer, a target and an image of the target are inverted with a set of nonlinear polynomial equations to obtain a temperature profile near the earth's surface. The temperature that is predicted at a specific height with the inversion of optical data is verified with a temperature that was measured with thermocouples when the optical data were collected. When the maximum uncertainty of + or - 0.04 C in the measured temperature is known, the largest difference between the measured temperature and the temperature obtained with the optical data is within + or - 0.02 C. The inversion of optical data with these nonlinear polynomial equations produces a set of coefficients that is used to calculate the temperature profile. Dissert. Abstr.

N79-22702 State Univ. of New York at Albany.
LABORATORY STUDIES OF THE SHAPES OF HAILSTONES Ph.D. Thesis
Steven Barry Newman 1978 65 p
Avail: Univ. Microfilms Order No. 7907221

Artificially produced hailstones of various diameters were suspended in the updraft of a small vertical wind tunnel and allowed to melt for time intervals up to five minutes. It is hypothesized that this melting is analogous to the wet growth phase of hailstones in supercooled clouds during the time when large accreted drops presumably form a layer of slowly freezing water on hail surfaces. It was observed that films of liquid water which accumulated on the hailstones surface served to mold and reshape the hailstone from its original shape. In clouds, the development of various shapes is believed to be the result of aerodynamic molding of the surface of the hailstone during the wet growth phase by a film of liquid water. The surface temperature of the stone rapidly comes to 0 C when covered by such a film and the shape which develops is dependent on the terminal velocity of the stone. Dissert. Abstr.

N79-22703 Saint Louis Univ., Mo.
INFLUENCE OF PERTURBATION PRESSURE FORCES ON THE MOVEMENT OF A MATURE, QUASI-STEADY, GREAT PLAINS SUPERCELL THUNDERSTORM Ph.D. Thesis
Roger Carter Whiton 1978 207 p
Avail: Univ. Microfilms Order No. 7908316

A three-dimensional model of a severe, rotating, Great Plains supercell thunderstorm in its steady state right- or left-moving stage was used to study the internal dynamics structure, and movement of a typical severe thunderstorm. Results indicate the jet-like inner core updraft of the model storm acts to a large extent as a fluid obstacle to the invading environmental air and is rather well protected from the effects of lateral entrainment. The storm has two updrafts: a primary updraft at the core attributable entirely to the Rankine combined vortex, and a secondary updraft induced by dynamical interaction between the storm's core and its environment. The secondary, dynamically induced updraft of a cyclonically rotating storm is in the right-front quadrant of right-moving storms and in the left-front quadrant of left-movers. The magnitude of the dynamically induced up- and downdrafts in the model is controlled by the vertical shear of the horizontal environmental winds relative to the storm. Dissert. Abstr.

N79-22704*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
VERTICAL MOTIONS IN THE EQUATORIAL MIDDLE ATMOSPHERE Final Report
Morris Larry Weisman Washington NASA Apr. 1979 121 p refs
(Contract NAS6-2726)
(NASA-CR-3096) Avail: NTIS HC A06/MF A01 CSCL 04B

A single station vertical velocity equation which considers ageostrophic and diabatic effects derived from the first law of thermodynamics and a generalized thermal wind relation is presented. An analysis and verification procedure which accounts for measurement and calculation errors as well as time and space continuity arguments and theoretical predictions are described. Vertical velocities are calculated at every kilometer between 25 and 60 km and for approximately every three hours for the above diurnal period at Kourou (French Guiana), Fort Sherman (Panama Canal Zone), Ascension Island, Antigua (British West Indies) and Natal (Brazil). The results, plotted as time series cross sections, suggest vertical motions ranging in magnitude from 1 or 2 cm/sec at 30 km to as much as 15 cm/sec at 60 km. Many of the general features of the results agree well with atmospheric tidal predictions but many particular features suggest that both smaller time scale gravity waves (periods less than 6 hours) and synoptic type waves (periods greater than 1 day) may be interacting significantly with the tidal fields. The results suggest that vertical motions can be calculated for the equatorial middle atmosphere and must be considered a significant part of the motion for time scales from 8 to 24 hours. Author

N79-22705*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
MESOSPHERIC HEATING DUE TO INTENSE TROPOSPHERIC CONVECTION Final Report
Lauren Ludlum Taylor Washington NASA Apr. 1979 62 p refs
(Contract NAS6-2818)
(NASA-CR-3132) Avail: NTIS HC A04/MF A01 CSCL 04B

A series of rocket measurements made twice daily at Wallops Island, Va., revealed a rapid heating of the mesosphere on the order of 10 K on days when thunderstorms or squall lines were in the area. This heating is explained as the result of frictional dissipation of vertically propagating internal gravity waves generated by intense tropospheric convection. Ray-tracing theory is used to determine the spectrum of gravity wave groups that actually reach mesospheric heights. This knowledge is used in an equation describing the spectral energy density of a penetrative convective element to calculate the fraction of the total energy initially available to excite those waves that do reach the level of heating. This value, converted into a vertical velocity, is used as the lower boundary condition for a multilayer

model used to determine the detailed structure of the vertically propagating waves. The amount of frictional dissipation produced by the waves is calculated from the solutions of the frictionless model by use of a vertically varying eddy viscosity coefficient. The heating produced by the dissipation is then calculated from the thermodynamic equation. L.S.

N79-22706*# Dayton Univ. Research Inst., Ohio.
FROST FORMATION ON AN AIRFOIL: A MATHEMATICAL MODEL 1 Final Report
Mark Dietenberger (Dayton Univ. Research Inst., Ohio), Prem Kumar (Dayton Univ. Research Inst., Ohio), and James Luers (Dayton Univ. Research Inst., Ohio) Apr. 1979 80 p refs
(Contract NAS8-31294)
(NASA-CR-3129; UDR-TR-78-123) Avail: NTIS HC A05/MF A01 CSCL 04B

A computer model to predict the frost formation process on a flat plate was developed for application to most environmental conditions under which frost occurs. The model was analytically based on a generalized frost thermal conductivity expression, on frost density and thickness rate equations, and on modified heat and mass transfer coefficients designed to fit the available experimental data. The broad experimental ranges reflected by the extremes in ambient humidities, wall temperatures, and convective flow properties in the various publications which were examined served to severely test the flexibility of the model. An efficient numerical integration scheme was developed to solve for the frost surface temperature, density, and thickness under the changing environmental conditions. The comparison of results with experimental data was very encouraging. Author

N79-22707*# TRW Systems and Energy, Redondo Beach, Calif.
ANALYTIC STUDIES ON SATELLITE DETECTION OF SEVERE, TWO-CELL TORNADOES Final Report
George F. Carrier (TRW Systems and Energy, Redondo Beach, Calif.), Paul Dergarabedian (TRW Systems and Energy, Redondo Beach, Calif.), and Francis E. Fendell (TRW Systems and Energy, Redondo Beach, Calif.) Washington NASA Apr. 1979 71 p refs
(Contract NAS1-14578)
(NASA-CR-3127) Avail: NTIS HC A04/MF A01 CSCL 04B

From funnel-cloud-length interpretation, the severe tornado is characterized by peak swirl speed relative to the axis of rotation of about 90 m/s. Thermohydrodynamic achievement of the pressure deficit from ambient necessary to sustain such swirls requires that a dry, compressionally heated, non-rotating downdraft of initially tropopause-level air lie within an annulus of rapidly swirling, originally low-level air ascending on a near-moist-adiabatic locus of thermodynamic states. The two-cell structure furnishes an observable parameter possibly accessible to a passively instrumented, geosynchronous meteorological satellite with mesoscale resolution, for early detection of a severe tornado. Accordingly, the low-level turnaround region, in which the surface inflow layer separates to become a free ascending layer and for which inviscid modeling suffices, is examined quantitatively. Preliminary results indicate that swirl overshoot, i.e., swirl speeds in the turnaround region in excess of the maximum achieved in the potential vortex, is modest. Author

N79-22708*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RF RADIATION PRODUCED BY INTRACLOUD LIGHTNING DISCHARGES
D. M. LeVine, E. P. Krider, and C. D. Weidman Apr. 1979 17 p refs
(NASA-TP-1454; G-7951-03) Avail: NTIS HC A02/MF A01 CSCL 04B

The RF radiation produced during intracloud lightning flashes is presented, together with associated fast and slow electric field changes. These data were collected during the Thunderstorm Research International Project in Florida during the summer of 1977. The RF radiation is essentially simultaneous with the fast-field change but has a tendency to peak during the initial half-cycle of the bipolar field changes associated cloud processes. This is in marked contrast to previous observations of RF radiation during return strokes in cloud-to-ground discharges and provides a clue to the physics of the intracloud discharge. Author

N79-22709*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSES OF EARTH RADIATION BUDGET DATA FROM UNRESTRICTED BROADBAND RADIOMETERS ON THE ESSA 7 SATELLITE
William L. Weaver and Frederick B. House (Drexel Univ.) May 1979 56 p refs
(NASA-TP-1402; L-12587) Avail: NTIS HC A04/MF A01 CSCL 04B

Six months of data from the wide-field-of-view low resolution infrared radiometers on the Environmental Science Services Administration (ESSA) 7 satellite were analyzed. Earth emitted and earth reflected irradiances were computed at satellite altitude using data from a new in-flight calibration technique. Flux densitites and albedos were computed for the top of the earth's atmosphere. Monthly averages of these quantities over 100 latitude zones, each hemisphere, and the globe are presented for each month analyzed, and global distributions are presented for typical months. Emitted flux densities are generally lower and albedos higher than those of previous studies. This may be due, in part, to the fact that the ESSA 7 satellite was in a 3 p.m. Sun-synchronous orbit and some of the comparison data were obtained from satellites in 12 noon sun-synchronous orbits. The ESSA 7 detectors seem to smooth out spatial flux density variations more than scanning radiometers or wide-field-of-view fixed-plate detectors. Significant longitudinal and latitudinal variations of emitted flux density and albedo were identified in the tropics in a zone extending about + or - 25 deg in latitude. Author

N79-22710# Digital Programming Services, Inc., Waltham, Mass.
DEVELOPMENT AND APPLICATION OF MATHEMATICAL PROCEDURES TO A VARIETY OF CLOUD PHYSICS RESEARCH DATA Final Report, 1 Jul. 1976 - 30 Apr. 1978
Lawrence E. Belsky, Michael W. Francis, Fredric B. Kaplan, Daniel Leach, and Keith Roberts 30 Jun. 1978 275 p refs
(Contract F19628-76-C-0241)
(AD-A064781; AFGL-TR-78-0170) Avail: NTIS HC A12/MF A01 CSCL 04/2

This report summarizes the mathematical procedures used on a variety of standard and non-standard cloud physics data. It includes the complete descriptions and operating instructions for all programs developed under this contract. Author (GRA)

N79-22711# Air Force Geophysics Lab., Hanscom AFB, Mass.
A REPORT ON EXPERIMENTS WITH THE AFGWC BOUNDARY LAYER MODEL Interim Report
Chien-Hsiung Yang and Karekin Agazarian 2 Oct. 1978 36 p refs
(AD-A065061; AFGL-TR-78-0239; AFGL-AFSG-397) Avail: NTIS HC A03/MF A01 CSCL 04/2

Experiments were carried out to find means of improving the forecast performance of the Air Force Global Weather Central (AFGWC) Boundary Layer Model. The results suggest that modifications in the methods of estimating eddy diffusivity and surface specific humidity may yield a slight improvement in the forecast accuracy while requiring less computation. It is also demonstrated that doubling the time step from 30 to 60 min does not significantly degrade the forecast accuracy. Suggestions on further modifications under less restrictive operational conditions are also included. Author (GRA)

N79-22712# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE LASER LIGHTNING ROD SYSTEM: A FEASIBILITY STUDY M.S. Thesis. Final Report, May - Dec. 1977
Charles W. Schubert, Jr. Jun. 1978 115 p refs
(AD-A063847; AFFDL-TR-78-60) Avail: NTIS HC A06/MF A01 CSCL 04/2

The feasibility of triggering lightning with an intense laser pulse is investigated. Physical mechanisms by which such triggerings might occur are examined, and criteria for lightning initiation with a laser beam established. A differential equation for determining the free electron distribution along a kilometer long laser beam is developed, based on the electron-cascade model of gas breakdown. Predictions are made of the electron distribution along laser beams of various focal lengths, wave-

lengths, pulse shapes, pulse lengths, and flux intensities. The predicted densities are compared with the criteria for triggering lightning. A conclusion is drawn that the triggering of lightning with a laser pulse is feasible from the standpoint of the physics involved; but would require large laser apertures, short pulse lengths, and flux intensities at the aperture near the threshold for the breakdown of air. Author (GRA)

N79-22713# Air Force Geophysics Lab., Hanscom AFB, Mass.
CIRRUS PARTICLE DISTRIBUTION STUDY, PART 2 Air Force Surveys in Geophysics
D. J. Varley 10 Oct. 1978 104 p refs
(AD-A063807; AFGL-TR-78-0248-Pt-2; AFGL-AFSG-399) Avail: NTIS HC A06/MF A01 CSCL 04/2

This report presents particle spectrometer data obtained by the AFGL instrumented MC-130E aircraft during a flight through various types of cirriform clouds in the Albuquerque area on 26 February 1978. The data consist of average particle concentration figures as a function of size for consecutive 30-sec periods during the 96-min sampling mission. Additionally, data for some particular 15-sec segments of the flight are closely examined. These segments, selected to represent various cirriform conditions, as dense cirrostratus and thin cirrus, are documented with aircraft nose camera photographs of clouds and with plots of resulting particle concentrations and calculations of liquid water content. Author (GRA)

N79-22714# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) WILLOW GROVE, PENNSYLVANIA Reference Report, 1945 - 1977
Jul. 1978 374 p
(AD-A063832) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations at Willow Grove Naval Air Station, Pennsylvania. The six parts are: Part 1 - Weather Conditions/Atmospheric Phenomena, Part 2 - Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 - Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, and Part 6 - Station Pressure/Sea Level Pressure. GRA

N79-22715# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) WHITING FIELD, FLORIDA Reference Report, 1945 - 1977
Jul. 1978 374 p
(AD-A063831) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations Whiting Field Naval Air Station, Milton, Florida. The six parts are: Part 1 - Weather Conditions/Atmospheric Phenomena, Part 2 - Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 - Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, and Part 6 - Station Pressure/Sea Level Pressure. GRA

N79-22716# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) OCEANA, VIRGINIA Reference Report, 1945 - 1977
Jul. 1978 375 p
(AD-A063837) Avail: NTIS HC A15/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part 1 - Weather Conditions/Atmospheric Phenomena, Part 2 Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 - Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, and Part 6 - Station Pressure/Sea Level Pressure. Author (GRA)

N79-22717# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) PENSACOLA, FLORIDA Reference Report, 1955 - 1977
Jul. 1978 360 p
(AD-A063836) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part 1 - Weather Conditions/Atmospheric Phenomena, Part 2 Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 - Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, and Part 6 - Station Pressure/Sea Level Pressure. Author (GRA)

N79-22718# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) QUANTICO, VIRGINIA Reference Report, 1945 - 1977
Jul. 1978 82 p
(AD-A063834) Avail: NTIS HC A05/MF A01 CSCL 04/2

This data report consits of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure. Author (GRA)

N79-22719# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS (SSMO) SOUTH AMERICA AND SELECTED ISLAND COASTAL MARINE AREAS WEST COAST. VOLUME 5: AREA 31, MOLLENDO; AREA 32, LIMA; AREA 33, PUNTA NEGRA; AREA 34, GUAYAQUIL; AREA 35, BUENAVENTURA SW; AREA 36, GULF OF PANAMA; AREA 37, GALAPAGOS ISLANDS
Feb. 1979 480 p
(AD-A064337) Avail: NTIS HC A21/MF A01 CSCL 04/2

This report presents marine climatological data for specific coastal areas in 21 different tables including weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period, sea surface temperature and sea level pressure. Author (GRA)

N79-22720# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) ROOSEVELT ROADS, PUERTO RICO Reference Report, 1948 - 1977
Jul. 1978 356 p
(AD-A063835) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part 1 - Weather Conditions/Atmospheric Phenomena, Part 2 Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 -Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, and Part 6 - Station Pressure/Sea Level Pressure. Author (GRA)

N79-22721# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS (SSMO), SOUTH AMERICA AND SELECTED ISLAND COASTAL MARINE AREAS, WEST COAST. VOLUME 4. AREA 25-MAGELLAN STRAIT WEST, AREA 26-GULF OF PENAS, AREA 27-VALDIVIA, AREA 28-VALPARAISO, AREA 29-COQUIMBO, AREA 30-ANTOFAGASTA
Feb. 1979 486 p
(AD-A064027) Avail: NTIS HC A21/MF A01 CSCL 04/2

This report presents marine climatological data for specific coastal areas in 21 different tables including weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period, sea surface temperature and sea level pressure. Author (GRA)

N79-22722# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) BARBERS POINT, HAWAII Reference Report, 1949 - 1977

Jun. 1978 357 p
(AD-A063827) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part 1 - Weather Conditions/Atmospheric Phenomena, Part 2 Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 - Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, Part 6 - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-22723# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) SANTA ANA, CALIFORNIA Reference Report, 1945 - 1977
Jul. 1978 364 p
(AD-A063833) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations at Santa Ana California. The six parts are: Part 1 Weather Conditions/Atmospheric Phenomena, Part 2 Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 - Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, and Part 6 - Station Pressure/Sea Level Pressure.
GRA

N79-22724# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) DIEGO GARCIA Reference Report, 1951 - 1977
Jul. 1978 357 p
(AD-A063828) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part 1 - Weather Conditions/Atmospheric Phenomena, Part 2 Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 - Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, and Part 6 - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-22725# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) MCMURDO STATION, ANTARCTICA Reference Report, 1956 - 1977
Jul. 1978 342 p
(AD-A063829) Avail: NTIS HC A15/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part 1 - Weather Conditions/Atmospheric Phenomena, Part 2 Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 - Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, and Part 6 - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-22726# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) MIRAMAR, CALIFORNIA Reference Report, 1947 - 1977
Jul. 1978 370 p
(AD-A063830) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations at Miramar Naval Air Station, California. The six parts are: Part 1 - Weather Conditions/Atmospheric Phenomena, Part 2 - Precipitation/Snowfall/Snow Depth, Part 3 - Surface Winds, Part 4 - Ceiling versus Visibility/Sky Cover, Part 5 - Psychrometric Summaries, Part 6 - Station Pressure/Sea Level Pressure.
GRA

N79-22727# Pacific Fleet, FPO San Francisco 96610. Third Fleet.
OPERATIONAL PLANNER'S GUIDE TO CLIMATOLOGICAL DATA SOURCES
3 Jan. 1979 93 p refs
(AD-A064669; TACMEMO-610-3-78) Avail: NTIS HC A05/MF A01 CSCL 04/2

This document is addressed to those who plan naval operations. Its purpose is to promote and facilitate the introduction of climatological considerations into that planning process. It provides aid to the planner in identifying, selecting, and obtaining appropriate climatological data sources, and guidance in the use of the data thus obtained. The use of this manual should not discourage or supplant communication between operational planners and Naval Weather Service activities or environmental staff personnel; these remain the primary sources of timely forecasts and expert consultation. Rather, it should aid such communication by providing both information and stimulation. The manual identifies and describes a large number of reference publications; in aggregate they would occupy a small library. The manual's intent is to acquaint the planner with these publications and to enable him to select those he may require. It may also aid him in seeking temporary use of some publications, for most of them are held by Naval Weather Service activities and major operational commands.
Author (GRA)

N79-22728# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19303A GSRS MISSILE NUMBERS 1015 AND 1016, ROUND NUMBERS V-15 AND V-16
Feb. 1979 32 p
(DA Proj. 1T6-65702-D-127)
(AD-A065003; DR-984) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19303A GSRS, Missile Number 1015 and 1016, Round Numbers V-15 and V-16, are presented in tabular form.
Author (GRA)

N79-22729# SRI International Corp., Menlo Park, Calif.
TRACKING AND MONITORING HURRICANES BY HF SKYWAVE RADAR OVER THE GULF OF MEXICO Final Report, 14 Jul. 1976 - 30 Nov. 1978
Joseph W. Maresca, Jr. and Christopher T. Carlson Nov. 1978 111 p refs
(Contract F49620-76-C-0023; AF Proj. 2310)
(AD-A064972; AFOSR-79-0042TR) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report describes the results of a study to evaluate the effectiveness of a high-frequency (HF) skywave radar used to determine (1) the track of a hurricane, and (2) hurricane wind velocity and wave height throughout all regions of a storm. Experimental data were collected using the SRI-operated Wide Aperture Research Facility (WARF) located in central California. The WARF radar is a high-resolution skywave radar capable of forming a 0.5 deg beam at 15 MHz. HF skywave radar sea-echo Doppler spectra were recorded for six hurricanes/tropical storms in the Gulf of Mexico and Pacific Ocean between 1975 and 1978. Both day and night measurements were made, as well as one and two-ionospheric-hop measurements ranging out from 2800 to 4000 km. Surface wind direction maps were computed for all 6 tropical storms. In situ measurements were available for two storms for comparison to the WARF radar wind maps. The radar-derived wind directions coincident in time and space with National Data Buoy Office moored buoys showed agreement to within 10 deg. The center of the hurricane was estimated from each WARF wind map and was compared to the official track compiled by the National Hurricane Center (NHC). The mean difference between the WARF radar positions and the interpolated positions along the NHC track was 19 km for Hurricane Anita 1977.
GRA

N79-22730# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIND FIELD AND TRAJECTORY MODELS FOR TORNADO-PROPELLED OBJECTS Final Report
Gunther Redmann, John R. Radbill, Jack E. Marte, Paul Dergarabedian (TRW Systems Div., Bedondo Beach, Calif.), and Francis E. Fendell (TRW Systems Div., Redondo Beach, Calif.)
May 1978 250 p refs Sponsored by EPRI
(EPRI-NP-748; FR-2) Avail: NTIS HC A11/MF A01

The report contains the results of the second phase of a research program which has as its objective the development of a mathematical model to predict the trajectory of tornado-borne objects postulated to be in the vicinity of nuclear power plants. An improved tornado wind field model satisfies the no-slip ground boundary condition of fluid mechanics and includes the functional dependence of eddy viscosity with altitude. Sub-scale wind

tunnel data are obtained for all of the missiles currently specified for nuclear plant design. Confirmatory full-scale data are obtained for a 12-inch pipe and automobile. The original six-degree-of-freedom trajectory model is modified to include the improved wind field and increased capability as to body shapes and inertial characteristics that can be handled. The improved trajectory model is used to calculate maximum credible speeds, which for all of the heavy missiles are considerably less than those currently specified for design. Equivalent coefficients for use in three-degree-of-freedom models are developed and the sensitivity of range and speed to various trajectory parameters for the 12-inch diameter pipe is examined. ERA

N79-22731# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.

COMPUTER TRACKING OF TEMPERATURE-SELECTED CLOUD PATTERNS

Lester F. Hubert Jan. 1979 20 p refs

(PB-292159/1; NOAA-TM-NESS-102; NOAA-79012302) Avail: NTIS HC A02/MF A01 CSCL 04B

Cloud-tracking experiments were performed with Geostationary Operational Environmental Satellite (GOES) infrared picture sequences after the images had been modified by deleting various threshold temperatures. The purpose was to assess the effectiveness of this type of image manipulation for segregating cloud layers for computer tracking. The temperature-threshold technique was found to be effective in a restricted range of situations where a single temperature threshold could be applied to isolate either a high-level or a low-level cloud pattern. These experiments showed that temperature thresholding is not applicable to routine use for all cloud layers. Rather it is an auxiliary tool more useful for diagnosis and development. An incidental result was the finding that all tracking algorithms appeared to underestimate speed of cloud patterns. GRA

N79-22732# National Environmental Satellite Service, Washington, D. C.

THE ECONOMIC BENEFITS OF ENVIRONMENTAL SATELLITES

W. John Hussey and E. Larry Heacock Apr. 1978 37 p refs Presented at the 4th Ann. Conv. of the Eastern Econ. Assoc., Washington, D. C., 27 Apr. 1978

(PB-292340/7; NOAA-79012303) Avail: NTIS HC A03/MF A01 CSCL 04B

Satellite observations of the atmosphere on a global scale began 18 years ago this month. In the intervening period, satellite sensors and techniques for the use of the data which these sensors provide have evolved to a high state of proficiency. This paper seeks to identify and quantify (to the extent possible) a number of the most dramatic cost benefits presently being derived from the United States' Operational Environmental Satellite System. A comparison is made with the annual budget for operating the satellite system. GRA

N79-22733# National Environmental Satellite Service, Washington, D. C.

A COMPARISON OF SATELLITE OBSERVED MIDDLE CLOUD MOTION WITH GATE RAWINSONDE DATA

Leroy D. Herman Jan. 1979 20 p refs

(PB-292341/5; NOAA-TM-NESS-101) Avail: NTIS HC A03/MF A01 CSCL 04B

Satellite middle cloud vectors were compared with GATE rawinsondes to determine their accuracy and altitudes. A method was derived for the estimation of middle level vector deviation of satellite vectors from corresponding balloon winds at the estimated altitude was 9.6 kt. GRA

N79-22734# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.

SUMMARY OF GREAT LAKES WEATHER AND ICE CONDITIONS, WINTER 1976-77

F. H. Quinn, R. A. Assel, D. E. Boyce, G. A. Leshkevich, and C. R. Snider Oct. 1978 155 p refs

(PB-292613/7; NOAA-TM-ERL-GLERL-20; NOAA-79012905) Avail: NTIS HC A08/MF A02 CSCL 04B

The winter of 1976-77 was the fifth coldest in the past 200 years. Record-breaking low temperatures from mid-October to mid-February, associated with an upper air pressure pattern consisting of a strong ridge in the westerly flow over North America, resulted in extraordinary ice cover on the Great Lakes. Ice was produced almost simultaneously in various shallow protected areas of the Great Lakes in early December. The progression of early winter, mid-winter, and maximum ice extent was was 4 to 5 weeks earlier than normal. At the time of maximum ice extent in early February, Lake Superior was approximately 83% ice covered, Lake Michigan over 90%, Lake Huron approximately 89%, Lake Erie 100 %, and Lake Ontario approximately 38%. Spring breakup started in late February in the southern part of the Great Lakes region and in early March in the northern part. GRA

N79-22735# National Weather Service, Columbia, S. C.

STATE OF SOUTH CAROLINA, WEATHER AND CROP SUMMARIES, 1977

John Purvis and Roger Foster Aug. 1978 71 p Prepared in cooperation with South Carolina Water Resources Commission and South Carolina Crop Reporting Service, Columbia

(PB-292591/5; NOAA-79010202) Avail: NTIS HC A04/MF A01 CSCL 04B

Monthly weather and crop data are summarized in maps and tables for each month are summarized in maps and tables for each month of 1977. Brief explanatory notes are included. GRA

N79-22736# Texas Dept. of Water Resources, Austin. Water Modification and Technology Section.

WEATHER MODIFICATION ACTIVITIES IN TEXAS, 1974 1977

Aug. 1978 67 p

(PB-291345/7; TDWR/R-219) Avail: NTIS HC A04/MF A01 CSCL 04B

Weather modification programs conducted in Texas from 1974 through 1977 are described. The Department's participation in private and public programs dealing with research development and evaluation of cloud-seeding is discussed. Some citizen groups used commercial cloud-seeding forms or invested in their own equipment and personnel to accomplish the cloud-seeding operations. All licenses and permits issued during the 1974-1977 period are cited and the activities, methods employed, and chemicals used are described. GRA

N79-22737# National Bureau of Standards, Washington, D. C. Fluid Engineering Div.

CHARACTERISTICS OF HELICOID ANEMOMETERS Final Report

J. M. McMichael and W. G. Cleveland Aug. 1978 17 p refs Sponsored in part by FHA

(PB-291987/6; NBSIR-78-1505) Avail: NTIS Hc A02/MF A01 CSCL 04A

An experimental study of the overspeeding error for helicoid anemometers in periodic air flows is described. The range of amplitude and frequency for which a simple nonlinear model for the dynamic response of such instruments remains valid are presented. It is shown that the model is valid for typical atmospheric applications of such instruments. A simple method is presented whereby the effects of inertial lag and nonlinearity may be taken into account in obtaining measurements of a long wind power spectra in the atmosphere. GRA

N79-22738# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

MASS DIVERGENCE IN TROPICAL WEATHER SYSTEMS. PAPER 1: DIURNAL VARIATION. PAPER 2: LARGE-SCALE CONTROLS ON CONVECTION Atmospheric Science Paper

John L. McBride and William M. Gray Nov. 1978 120 p refs

(Grant NOAA-04-6-022-44036)

(PB-289997/9; AS-Paper-299; ISSN-0067-0340) Avail: NTIS HC A06/MF A01 CSCL 04B

Paper (1) documents the diurnal variation of mass divergence and vertical velocity for tropical summertime oceanic weather systems in the Western Pacific, Western Atlantic and the GATE region. The diurnal variation is large, has the same basic characteristics in all regions and supports the radiation-convection of forcing hypothesis. Paper (2) demonstrates that the observed vertical motion of tropical weather systems is governed by the

large scale forcing mechanisms of ITCZ convergence, a diurnal variation of ITCZ inflow, easterly waves, differential radiative convective heating, frictional convergence, and convective feedback. Calculations are performed to estimate the relative contribution of each forcing mechanism. GRA

N79-22739# Electronic Techniques, Inc., Fort Collins, Colo.
AUTOMATIC ENVIRONMENTAL SURFACE OBSERVATION PLATFORMS (AESOP) FOR THE HIGH PLAINS EXPERIMENT (HIPLEX) Final Report
Vincent R. Scheetz and Gerald R. Price Dec. 1978 40 p refs
(Contract DI-6-07-DR-20030)
(PB-291750/8; ETI-78/12) Avail: NTIS HC A03/MF A01 CSCL 04B

Three Automatic Environmental Surface Observation Platforms (AESOP) were tested and evaluated under field conditions, and data comparisons were made using other independent observations of weather parameters. Two AESOP's were installed at manned sites in the Sierra Nevada Mountains and operated during the winter of 1977-78. The third AESOP was installed at Eads, Colorado and operated during the period April to June 1978. All three AESOP were outfitted with solar panels and new humidity sensors and were relocated to remote sites in the Sierra Nevada Mountains in the fall of 1978. AESOP's were shown to be reliable sources of weather information even in extreme environments, operating for a period of over three months with no electronic failures. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-22740 Northwestern Univ., Evanston, Ill.
SOME CHEMICAL ASPECTS OF HYDROTHERMAL PROCESSES AT MID-OCEANIC RIDGES: A THEORETICAL STUDY. 1: BALTIC-SEA WATER REACTION AND CHEMICAL CYCLING BETWEEN THE OCEANIC CRUST AND THE OCEANS. 2: CALCULATION OF CHEMICAL EQUILIBRIUM BETWEEN AQUEOUS SOLUTIONS AND MINERALS Ph.D. Thesis
Thomas Jay Wolery 1978 275 p
Avail: Univ. Microfilms Order No. 7907954

Numerical techniques for modelling partial equilibrium reactions among aqueous solutions and minerals were developed and applied to the titration of sea water by basalt in isothermal, closed systems at 500 bars, over the temperature range 0-340 C, up to high values of rock-water ratio (100-1000 g/kg). It is inferred that the experimental systems were not overall grossly out of equilibrium (two aspects of disequilibrium were simple: maintenance of quartz super-saturation and lack of redox equilibrium between species of iron and sulfur) and that the theoretical calculations are fruitful with currently available thermodynamic data. Basaltic glass appears to dissolve homogeneously at high temperature. The theoretical computations enhance and extend the knowledge of basalt-sea water reaction obtained by experimental studies. Dissert. Abstr.

N79-22741# Bern Univ. (Switzerland). Physikalisches Inst.
He, Ne AND Ar COMPOSITION IN A NEUTRON ACTIVATED SEA-FLOOR BASALT GLASS
A. Stettler and P. Bochsler Aug. 1978 44 p refs Revised
Submitted for publication
Avail: NTIS HC A03/MF A01

The composition of helium, neon and argon in the glassy rim of a fresh oceanic basalt form the East Pacific Rise was measured. Three splits of the sample were subjected to neutron irradiation prior to analysis to investigate the noble gas release as a function of different neutron dose. Including the He and Ne results from the irradiated specimens, it was possible to determine the concentrations of Li and Mg and to estimate upper limits for Na and F in addition to the concentrations of K, Ca and Cl which are measured routinely as a byproduct of the Ar-39-Ar-40 dating method. G.Y.

N79-22742# Florida State Univ., Tallahassee. Dept. of Oceanography.
A METHOD FOR CALCULATING WAVE PACKET TRAJECTORIES AND WAVE HEIGHTS, PART 1
J. Ernest Breeding, Jr., K. C. Matson (Naval Coastal Systems Center), and Nourollah Riahi (Winthrop Coll., Rock Hill, S. C.) Mar. 1978 111 p refs 2 Vol.
(Contract N00014-77-C-0329)
(AD-A064110; TR-JEB-1-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 08/3

The theory and numerical methods are presented for determining the paths of gravity water wave packets. A ray curvature expression is used to determine the wave packet trajectories where the speed of the packet is given by G = (d omega/dk) cos phi. The symbol omega denotes the angular frequency, k is the wave number, and phi is the difference between the direction of the wave packet and the direction of the wavelets within the packet. At each point of the wave packet trajectory the wavelet direction is determined using Snell's law with phase velocity. The wave height is computed along the wave packet paths accounting for the effects of shoaling, refraction, and energy dissipation. The computer program is described and sample printouts and plots are presented. GRA

N79-22743# Florida State Univ., Tallahassee. Dept. of Oceanography.
A METHOD FOR CALCULATING WAVE PACKET TRAJECTORIES AND WAVE HEIGHTS, PART 2
J. Ernest Breeding, Jr. Nov. 1978 37 p 2 Vol.
(Contract N00014-77-C-0329)
(AD-A064078; TR-JEB-4-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 08/3

In Part I a method for calculating wave packet trajectories and wave heights is based on the assumption that the water depth contours are locally parallel in the vicinity of each ray point. This method is extended in order to predict the modification to surface gravity water waves in shoaling water when the water depth contours are not parallel. The calculations are greatly simplified by choosing a coordinate system at each ray point in which one axis is aligned parallel with the direction of the gradient of the water depth. Example printouts and plots are presented to illustrate the wave prediction method. It is discovered that when waves initially approach sinuous water depth contours symmetrically with respect to the beach there can be more energy in the bays than at the headlands. Author (GRA)

N79-22744# Purdue Univ., Lafayette, Ind.
A FIELD INVESTIGATION OF THE SPATIAL AND TEMPORAL STRUCTURE OF LONGSHORE CURRENTS
Guy A. Meadows Dec. 1978 191 p refs
(Contract N00014-75-C-0716)
(AD-A064079; TR-6) Avail: NTIS HC A09/MF A01 CSCL 08/3

This field investigation was conducted to obtain simultaneous and continuous measurements of the horizontal, vertical and temporal variability of the longshore current flow field. The present study has resulted in a two-dimensional mapping, across the surf zone and with depth, of the longshore current field. The vertical structure of the mean longshore current flow field is nearly uniform with depth, with a narrow bottom boundary layer and sharp velocity gradients at the water-sediment interface. This investigation has also shown that the total longshore current velocity vector, at any point across the surf zone, is composed of three distinct velocity components. These components are: (1) a steady longshore current velocity component; (2) a long-period fluctuating velocity component which tends to be out-of-phase with the incident wave field and; (3) a short-period fluctuating longshore current velocity component which tends to be in-phase with the incident wave field. The results of this study have further indicated that neither the deterministic radiation stress approach to the prediction of longshore currents, nor a probabilistic formulation, provide adequate prediction of the magnitude or distribution of the longshore current velocity across the surf zone. In addition, the existence of a low velocity zone in the longshore current flow field has been isolated over the submarine bar. It appears that existing analytical formulations

for longshore current flow prediction must be re-evaluated in light of the findings of this study. Author (GRA)

N79-22745# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.

ACOUSTICALLY RELEVANT EDDY EFFECTS AND OCEAN SURFACE HEIGHT

M. J. Jacobson, W. L. Siegmann, S. Itzikowitz, and R. F. Henrick 1 Jan. 1979 23 p refs

(Contract N00014-76-C-0288)

(AD-A064103; RPI-MATH-122) Avail: NTIS HC A02/MF A01 CSCL 20/1

Underwater sound transmissions are significantly affected by the presence of mesoscale eddies, because large sound-speed variations and rotational currents are associated with these phenomena. Using an earlier axisymmetric eddy model, equations and graphs of the ocean surface are found above an eddy. The surface is elevated above an anticyclonic eddy and depressed in the cyclonic case (Northern Hemisphere). This behavior may be used to detect and partially classify an ocean eddy. With an appropriate eddy model, satellite altimeter data may be used to approximate acoustically-relevant effects. Author (GRA)

N79-22746# Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.

AN EXPERIMENTAL STUDY OF THREE-LAYER CIRCULATION

Martin Neil Raftenberg Jul. 1978 60 p refs

(Contract N00014-75-C-0805; Grant NSF OCE-76-18887)

(AD-A063744; TR-14-SER-C) Avail: NTIS HC A04/MF A01 CSCL 08/3

A 'three-layer circulation flow' which occurs typically in estuaries, was modelled in the laboratory. The experiments were designed to test theoretical predictions made by Long in an earlier analysis of the problem. The experiment consisted briefly of the following: a tank of length 496.6 cm and cross-section 37.2 cm x 15.9 cm was filled with two layers of water, each of 15.0 cm depth. The upper layer was fresh water and the lower layer was an NaCl-water solution with .25% or 1.00% salinity. After filling was completed, a 126.3 cm length at one end of the tank was blocked off, and the two fluid layers in this region were then thoroughly mixed, resulting in a homogeneous solution having salinity.125% or .50%. The partition separating the mixed region from the rest of the tank was removed, and a three-layer circulation flow ensued. Basically, fluid from the mixed region, having a density intermediate between the two layers outside of this region, was seen to flow out along the interface of these two layers. Simultaneously, flow in the reverse direction (into the mixed region) from the external layers was observed to occur. GRA

N79-22747# Naval Research Lab., Washington, D. C.

DEFINITION OF DIRECTIONAL WAVE SPECTRAL MEASUREMENT REQUIREMENTS FOR ACTIVE MICROWAVE SENSORS OF REMOTE OCEAN SURFACE MEASURING SYSTEMS Final Report

Davidson T. Chen Aug. 1978 54 p refs

(WF5253000)

(AD-A063383; AD-E000242; NRL-MR-3818) Avail: NTIS HC A04/MF A01 CSCL 08/3

One of the primary requirements for the active microwave sensors of the Remote Ocean Surface Measuring System (ROMS) is the measurement of directional ocean wave spectra. The measurement accuracy requirements on various applications, which are relevant and essential to the Navy's needs are delineated based upon their physical significance, detectability and physics involved. The sensor performance requirements in order to meet the required measurement accuracies are also derived based upon the sensor's precision, resolution, and accuracy in the measurements and the percentage of confidence in the processing techniques. The merge of the measurement accuracy requirements and the sensor performance requirements, necessary to meet these requirements on measurement accuracies, clearly link the theoretical and experimental scientific capabilities with those of the instrumental development, in this important area of concern, and from this established linkage a meaningful compromise between these two capabilities can be conjunctured with confidence. Author (GRA)

N79-22748# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.

THE RELATIONSHIP BETWEEN MARINE GRAVITY AND BATHYMETRY, PART 1. THEORY Progress Report, 1 Nov. 1976 - 31 Oct. 1977

Sean C. Solomon Sep. 1978 21 p

(Contract F19628-77-C-0027)

(AD-A063256; Scientific-1; AFGL-TR-78-0234-Pt-1) Avail: NTIS HC A02/MF A01 CSCL 08/5

The theoretical basis is outlined for a quantitative relationship between two-dimensional bathymetry and free air gravity in stable ocean basins. The relationship, suitable for use as an algorithm to predict gravity in areas where only bathymetry is known, is based on flexure theory for thin elastic plates and on the expected evolution with seafloor age of the isostatic response of oceanic lithosphere. Author (GRA)

N79-22749# California Univ., Berkeley. Dept. of Physics.

NUMERICAL ANALYSIS OF WEAKLY NONLINEAR WAVE TURBULENCE (HAMILTON'S PRINCIPLE, WAVE-WAVE INTERACTIONS, OCEANIC INTERNAL WAVES, RELAXATION PHENOMENA, STATISTICAL MECHANICS)

James D. Meiss, Neil Pomphrey, and Kenneth M. Watson Jan. 1979 33 p refs

(Contract N00014-78-C-0050)

(AD-A064546; UCB/PTH-79/2) Avail: NTIS HC A03/MF A01 CSCL 20/4

This paper studies the propagation of weakly nonlinear waves. The analysis is applicable to plasma waves, surface water waves, the interaction of laser beams with matter, particle accelerators, etc. The specific motivation for this work is, however, the study of internal waves in the ocean. Hamilton's principle is used to write the fluid equations in Hamiltonian form in terms of linear eigenmode amplitudes. Numerical studies are made of the effect of Fourier grid size and resonance widths. Statistical information is generated from an ensemble of initial states of the random wave field. Author (GRA)

N79-22750# National Weather Service, Salt Lake City, Utah. Western Region.

APPLICATION OF A SPECTRUM ANALYZER IN FORECASTING OCEAN SWELL IN SOUTHERN CALIFORNIA COASTAL WATERS

Lawrence P. Kierulff Jan. 1979 32 p refs

(PB-292716/8; NOAA-TM-NWS-WR-135; NOAA-79021201) Avail: NTIS HC A03/MF A01 CSCL 08C

The definitions and concepts of spectral ocean wave forecasting methods are reviewed and applied to the interpretation of trace records of the Snodgrass Spectrum Analyzer. Proper interpretation of the trace enables the prediction of arrival time and size of heaviest surf. Tables derived from the Neumann Spectrum are fitted to the eight frequency channels of the analyzer and used to construct a hypothetical whole spectrum from a partially arrived swell spectrum. Case studies of a North Pacific winter storm, an Eastern Pacific Hurricane, and a Southern Hemisphere storm are made. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-22751# Missouri Univ. -Kansas City.

CITRIC ACID ENHANCEMENT OF COPPER SULFATE TOXICITY TO THE BLUE-GREEN ALGAE "APHANIZOMENON FLOS-AQUAE" AND "MICROCYSTIS AERUGINOSA" M.S. Thesis

Lise Lavaughn Ray 1978 97 p refs

(Contracts DI-14-34-0001-7053; DI-14-34-0001-7054)

(PB-291637/7; W79-03037; OWRT-A-099-MO(1)) Avail: NTIS HC A05/MF A01 CSCL 06T

Copper toxicity tests were carried out using two species of blue-green algae. Aphanizomenon flos-aquae and Microcystis aeruginosa. Copper concentrations of 300 microgram/liter or higher inhibited the growth of Aphanizomenon. The addition of 600 microgram Cu++/liter was the minimum copper concentration necessary to inhibit Mocrocystis growth over a 14-day

experimental period. Copper solubility and cupric ion toxicity were enhanced by the addition of citric acid. Citric acid had no adverse effects on the algicidal properties of copper sulfate. A ratio of citric acid at eight times the weight of copper sulfate pentahydrate at a copper concentration of 500 microgram/liter (8:1 citrate-copper sulfate mixture) was inhibitory to Microcystis growth over a 14-day period, whereas the addition of 500 microgram Cu++/liter alone was not. The 8:1 mixture had the same effects as the addition of 600 microgram Cu++/liter. The increased cupric ion toxicity was not due to a pH effect.
GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-22752* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 192
Apr. 1979 84 p
(NASA-SP-7011(192)) Avail: NTIS HC E03 CSCL 06E

This bibliography lists 247 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1979. Author

N79-22753*# National Aeronautics and Space Administration, Washington, D. C.
A CUMULATIVE INDEX TO A CONTINUING BIBLIOGRAPHY ON AEROSPACE MEDICINE AND BIOLOGY
Jan. 1979 366 p
(NASA-SP-7011(189)) Avail: NTIS HC E05 CSCL 06E

A cumulative index to the abstracts contained in the Supplements 177 through 188 of Aerospace Medicine and Biology is presented. The bibliography includes three indexes: subject, personal author, and corporate source. S.E.S.

N79-22754# School of Aerospace Medicine, Brooks AFB, Tex.
ELECTRICAL PARAMETER VALUES OF SOME HUMAN TISSUES IN THE RADIOFREQUENCY RADIATION RANGE Interim Report, Oct. 1977 - Feb. 1978
John W. Penn and Earl L. Bell Dec. 1978 25 p refs
(AD-A064202; SAM-TR-78-38) Avail: NTIS HC A02/MF A01 CSCL 20/3

This report is an attempt to consolidate electrical parameter values of some human body tissues for the radiofrequency radiation range: 10 - 10,000 MHz. The sources of the data were widely distributed in scientific journals, books, and technical reports and included data points secured by experimental techniques, by computations (Debye or modified Debye equations), and by curve fitting methods. Values extracted from the conductivity and dielectric constant curves provided in the report give reasonable estimates of the interrelationships between various tissues over the frequency range of interest. These values are important in the study of effects of radiofrequency radiation on living organisms. Author (GRA)

N79-22755# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECTS OF PROPELLANT HYDRAZINES ON RED BLOOD CELLS: METHEMOGLOBIN AND HEINZ BODY FORMATION
Marilyn E. George, William E. Johnson, and Kenneth C. Back Dec. 1978 9 p refs
(AF Proj. 2312)
(AD-A064133; AMRL-TR-78-127) Avail: NTIS HC A02/MF A01 CSCL 06/16

Exposure to various hydrazine compounds causes methemoglobinemia and Heinz body production in human red blood cells. Three hydrazine compounds, monomethylhydrazine (MMH), 1,1-dimethylhydrazine (UDMH) and hydrazine (Hz) are principal components of several Air Force propulsion systems and exposure to any of these compounds produces a hemolytic anemia. The anemia following MMH exposure is characterized by methemoglobin and Heinz body formation. This study was designed to determine if UDMH and Hz exposure also produce these effects and to compare the effective dose levels. MMH is the most effective agent, producing these effects at concentrations eight to ten times lower than Hz. UDMH did not cause methemoglobinemia or Heinz bodies at the concentrations used indicating the probability of a different hemolytic mechanism. Author (GRA)

N79-22756# Duke Univ., Durham, N. C. Dept. of Ophthalmology.
ELECTROPHYSIOLOGICAL DETERMINATION OF RETINAL SENSITIVITY TO COLOR AFTER INTENSE MONOCHROMATIC LIGHT ADAPTATION Final Report, Dec. 1975 - Jan. 1977
Myron L. Wolbarsht Sep. 1978 53 p refs
(Contract F41609-76-C-0020; AF Proj. 7757)
(AD-A063852; SAM-TR-78-9) Avail: NTIS HC A04/MF A01 CSCL 20/5

The overall purpose of this research was to investigate a method for demonstrating changes in retinal ganglion-cell function after high-intensity radiation such as from a laser or other monochromatic source in the visible region. These experiments were designed to facilitate understanding functional retinal changes required to produce flash-blindness or permanent damage in human eyes, especially in the macular region which is so important in safety measures. Recordings were made from selected and well-characterized ganglion cells in animal retinas. Changes in receptive-field sensitivities were detected as a result of exposure to high-intensity monochromatic or broad-band light in part or all of the field. The time course of sensitivity recovery was also plotted. These results were then correlated with physiological and psychophysical data already known from other animal and human studies. The specific objective of this study was to delineate means by which ganglion cell responses could be used to evaluate color vision and visual-field loss after laser exposure of the monkey retina. Rabbit and cat retinas were used in developing the experimental techniques required for this evaluation. Author (GRA)

N79-22757# Center for Blood Research, Boston, Mass.
TEMPERATURE EFFECTS ON SHAPE AND FUNCTION OF HUMAN GRANULOCYTES Annual Report, 30 Nov. 1977 - 10 Nov. 1978
Fabian J. Lionetti, Stephen M. Hunt, R. J. Mattaliano, and C. R. Valeri Nov. 1978 31 p refs
(Contract N00014-73-C-0100; Grant PHS-CA-12178-06; NR Proj. 105-707; MR0410201)
(AD-A063750; TR-6) Avail: NTIS HC A03/MF A01 CSCL 06/16

Scanning microscopic and functional studies were made of granulocytes isolated from CPD anticoagulated whole blood by counterflow centrifugation in a Beckman JE-6 rotor. The collection buffer was phosphate (20 mM) buffered saline (280 mOsM) with glucose (28 mM) and human serum albumin (1.2% w/v). The final suspension contained less than 2% mononuclear cells and 5% red cells. Incubation and fixation at various temperatures revealed two distinct temperature dependent shape transformations. At 22, 37, 40 and 45 deg C granulocytes were ameboid with extensive highly textured veils. These smoothed progressively, bullae and blebs formed, and membranes peeled finally leaving nonfunctional spheres with smooth surfaces. At 4 deg C, granulocytes were irregular spheres, less rugose but with numerous microvilli and nodules. Veiling was absent. Phagocytosis, initially low, progressively declined over 48 hours while cell surfaces became smooth. Some formed blebs, but all terminated as nonfunctional spheres with untextured surfaces containing occasional large single holes. Cellular stability estimated from changes in volume distributions, and phagocytosis by microfluorescence measurements of yeast and latex particle ingestion were also temperature dependent and paralleled the shape progressions. It is concluded that at body (30 deg C) for fever (40 deg C) temperatures, granulocytes have dynamic membranar surfaces characterized by extensive veiling and high function. At 4 deg C they are relatively inactive spheres devoid of pseudopodia or veils, yet functional at slow rates. Author (GRA)

N79-22758# School of Aerospace Medicine, Brooks AFB, Tex.
HYBRID COMPUTATION OF LEFT VENTRICULAR PERFORMANCE USING NONINVASIVE TECHNIQUES Final Report,

Jan. 1976 - Jul. 1977
Edward L. Fitzpatrick, Paul J. Zalesky, Joel A. Strom, F. Wesley Baumgardner, and John W. Slaughter Dec. 1978 24 p refs (AF Proj. 7930)
(AD-A063749; SAM-TR-78-36) Avail: NTIS HC A02/MF A01 CSCL 06/16

An automated method for a beat-to-beat analysis of Systolic Time Intervals (STI) has been developed using a unilateral hybrid computer system. Beat number, time of occurrence of beat, heart rate preejection period (PEP), preejection period index (PEPI), left ventricular ejection time (LVEF), left ventricular ejection time index (ETI), total electromechanical systole (Q-S2), total electromechanical systole index (Q-S2I), isovolumic contraction time (IVCT), and ratio of PEP to LVET were calculated from simultaneous recordings of electrocardiogram, carotid pulse, and phonocardiogram. The ability of automated analysis to provide beat-to-beat values extends the usefulness of this noninvasive method to evaluate left ventricular performance. Author (GRA)

N79-22759# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CONTRAST SENSITIVITY OF THE HUMAN VISUAL SYSTEM AT ONE LUMINANCE LEVEL WHILE ADAPTED TO A STIMULUS AT ANOTHER LUMINANCE LEVEL M.S. Thesis
Charles G. Smith Dec. 1978 145 p refs
(AD-A064370; AFIT/GE/BE/78-42) Avail: NTIS HC A07/MF A01 CSCL 05/5

This report documents an investigation of the hypothesis that the organization of the receptive fields in the human visual system changes to compensate for changes in the average luminance of the visual stimulus. Foveal measurements of contrast sensitivity to sinusoidal spatial frequency were made at one luminance level while the subjects were adapted to a spatial sinusoid of a different average luminance. The luminance levels used were 3.65 and 35.5 ft-lamberts. Contrast sensitivity curves were generated for the range of spatial frequencies from 2 through 11 cycles per degree for adapting spatial frequencies of 4, 6, and 8 cycles per degree. Adaptation and testing at the same average luminance level produced a depression in the contrast sensitivity curve centered over the adapting spatial frequency. Adapting to a low luminance level stimulus and testing at a higher luminance level produced a shift in the adaptation depression to a lower spatial frequency. Adapting to a high luminance level and testing at a lower luminance level produced a shift to a higher spatial frequency. The shift in the adaptation depression was observed for red, green, blue, and white light stimuli and was observed for the unadapted eye of a subject whose other eye was adapted. Author (GRA)

N79-22760# Gulf South Research Inst., New Orleans, La.
EVALUATION OF TOXIC EFFECTS OF ORGANIC CONTAMINANTS IN RECYCLED WATER Final Report, 30 Sep. 1976 - 31 May 1978
Nachman Gruener Dec. 1978 111 p refs
(Contract EPA-68-03-2464)
(PB-291379/6; EPA-600/1-78-068) Avail: NTIS HC A06/MF A01 CSCL 06T

The results of a comprehensive series of toxicological studies designed to evaluate the health effects of the application of recycled water for drinking purposes are reported. Exposure for a limited time (20% of a lifespan) the concentrated, recycled water (about 100-1000 times present human exposure) does not lead to physiological changes in mice. Rodent and human cells were tested in vitro for general toxicity, mutagenicity, and carcinogenicity. Results for all three effects in the tissue cultures were positive. These effects were significantly increased by the presence of a liver activation system. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-22761*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HUMAN DISCOMFORT RESPONSE TO NOISE COMBINED WITH VERTICAL VIBRATION
Jack D. Leatherwood Apr. 1979 49 p refs
(NASA-TP-1374; L-12492) Avail: NTIS HC A03/MF A01 CSCL 05H

An experimental investigation was conducted (1) to determine the effects of combined environmental noise and vertical vibration upon human subjective discomfort response, (2) to develop a model for the prediction of passenger discomfort response to the combined environment, and (3) to develop a set of noise-vibration curves for use as criteria in ride quality design. Subjects were exposed to parametric combinations of noise and vibrations through the use of a realistic laboratory simulator. Results indicated that accurate prediction of passenger ride comfort requires knowledge of both the level and frequency content of the noise and vibration components of a ride environment as well as knowledge of the interactive effects of combined noise and vibration. A design tool in the form of an empirical model of passenger discomfort response to combined noise and vertical vibration was developed and illustrated by several computational examples. Finally, a set of noise-vibration criteria curves were generated to illustrate the fundamental design trade-off possible between passenger discomfort and the noise-vibration levels that produce the discomfort. L.S.

N79-22762# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ARPA AUTHORING SYSTEM Semiannual Technical Summary, 1 Apr. 1978 - 30 Sep. 1978
William P. Harris 30 Sep. 1978 16 p refs
(Contract F19628-78-C-0002; ARPA Order 3199)
(AD-A064723; ESD-TR-78-295) Avail: NTIS HC A02/MF A01 CSCL 05/9

A review is presented of the project to develop and field test the ARPA Authoring System for use by subject-matter experts in the preparation of task training in on-the-job environments. Materials were prepared according to the ARPA Authoring System procedures, and both preparation and delivery were on the facilities of the Lincoln Terminal System. An analysis of the lesson production rates for 30 lessons prepared by Air Force personnel revealed no systematic effects related to individual author, authoring experience, or lesson type. Preliminary results from a field test of the materials indicate that the lessons are sound. Large savings were found in the time trainees require to reach job qualification and in the amount of labor that subject-matter experts must dedicate to training duties. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-22763# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Mechanical and Industrial Engineering.
GRAPHIC DISPLAY OF HUMAN MOTION Technical Report, Oct. 1977 - Dec. 1978
K. D. Willmert Jan. 1979 7 p refs
(Contract N00014-76-C-0064; NR Proj. 064-548)
(AD-A064344; MIE-049) Avail: NTIS HC A02/MF A01 CSCL 05/5

Presented is the application of two and three dimensional graphic display models of a human body in studying the motion of a human being as a result of external influences. Included are an occupant during a vehicle crash and a parachutist during the opening of his chute. Author (GRA)

N79-22764# Human Engineering Labs., Aberdeen Proving Ground, Md.
AN INTERFACE EVALUATION OF THE XM-29 PROTECTIVE MASK AND THE AH-1S TELESCOPIC SIGHT UNIT Final Report
Paul F. Garrett, Jr. Oct. 1978 34 p refs

(AD-A064203; HEL-TN-12-78) Avail: NTIS HC A03/MF A01 CSCL 06/17

A field evaluation was conducted to determine the effect of the XM-29 protective mask on the mission performance of pilots in scout utility, and attack helicopter. The pilots flew air cavalry-type training missions while wearing the XM-29 and the M-24 protective mask. The evaluation was in accordance with unit training requirements, safety requirements and published standard operating procedures. The maneuvers evaluated included; hovering, out-of-ground effect hovering, nap-of-the-earth flight, aerial reconnaissance and target engagement with BTM 71A1 (inert TOW missile). Objective performance assessments were made by each pilot and his safety pilot. Subjective data was collected by using a bipolar adjective technique, debriefings and panel discussions. The data collected indicates an apparent user preference for the XM-29 protective mask. GRA

N79-22765# Wayne State Univ., Detroit, Mich. Dept. of Industrial Engineering and Operations Research.

HUMAN FACTORS ANALYSIS OF VISUAL DISTRESS SIGNALING DEVICES Final Report, 16 Aug. 1977 - 31 Oct. 1978

K. H. E. Kroemer and W. S. Marras Sep. 1978 77 p refs (Contract DOT-CG-72225-A)
(AD-A064174; USCG-D-84-78) Avail: NTIS HC A05/MF A01 CSCL 20/6

Visual Distress Signaling Devices (VDSD) should be designed for safe and efficient use by untrained boaters under adverse operational conditions. Thus, Ergonomics/Human Factors information should be used intensively to optimize the boater - VDSD interface. Research was performed to assess compliance with Human Engineering recommendations in existing VDSD. For this purpose, a field survey was conducted first, in which the VDSD were categorized. Critical Ergonomics/Human Factors aspects were established. Secondly, laboratory tests were performed that indicated the effects of selected Human Engineering design features on identification, unpackaging, and operation of VDSD. Finally, the research results were validated in (realistically simulated) emergencies. GRA

N79-22766# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AIRCREW MODULARIZED INFLIGHT DATA ACQUISITION SYSTEM M.S. Thesis

Robert E. Hill Dec. 1978 209 p refs
(AD-A064725; AFIT/GE/EE/78-28) Avail: NTIS HC A10/MF A01 CSCL 09/2

A baseline design of a School of Aerospace Medicine sponsored aircrew physiology monitor was accomplished. The monitor design requirements were: four hour battery operation; 2x5x9 inch size for man-mounting; record four hours of 13 parameters with 1% accuracy; and use nonmechanical, nonvolatile data storage. A system design study verifies the feasibility of implementing the monitor using an 8-bit digital data system containing magnetic bubble memory. The design is partitioned into four modules. GRA

N79-22135# Institute of Aviation Medicine, Farnborough (England).

HUMAN FACTORS IN SPACE VEHICLES AND SPACE STATIONS

P. Howard *In* Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle Vehicles, Vol. 2 1970 37 p (For primary document see N79-22130 13-12)
Avail: NTIS HC A22/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N79-22767# Wisconsin Univ. - Madison. Mathematics Research Center.

AN AUGMENT INTERFACE FOR BRENT'S MULTIPLE PRECISION ARITHMETIC PACKAGE

Richard P. Brent, Judith A. Hooper, and J. M. Yohe Aug. 1978 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A063966; MRC-TSR-1868) Avail: NTIS HC A03/MF A01 CSCL 09/2

The procedure required to interface the FORTRAN multiple precision package of Richard P. Brent (as described in ACM Transactions on Mathematical Software, March, 1978) with the AUGMENT precompiler for FORTRAN was described. The method of using the multiple precision arithmetic package in conjunction with AUGMENT was indicated. Author (GRA)

N79-22768# Wisconsin Univ. - Madison. Mathematics Research Center.

THE AUGMENT PRECOMPILER AS A TOOL FOR THE DEVELOPMENT OF SPECIAL PURPOSE ARITHMETIC PACKAGES

F. D. Crary (Boeing Co., Seattle, Wash.) and J. M. Yohe Oct. 1978 21 p refs
(Contract DAAG29-75-C-0024)
(AD-A063985; MRC-TSR-1892) Avail: NTIS HC A02/MF A01 CSCL 09/2

The use of a FORTRAN precompiler in the development of packages for nonstandard arithmetics is discussed. In particular, the use of the FORTRAN precompiler, AUGMENT, renders the source code more lucid, reduces the number of lines of code in a nonstandard arithmetic package, facilitates modification, and ameliorates the problems of transporting such a package to another host system. Author (GRA)

N79-22769# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

PRELIMINARY DESIGN OF A UNIVERSAL NETWORK INTERFACE DEVICE M.S. Thesis

Sam C. Sluzevich Dec. 1978 288 p refs
(AD-A064059; AFIT/GE/EE/78-41) Avail: NTIS HC A13/MF A01 CSCL 09/2

A preliminary design was developed for a special microprocessor based interface called the universal network interface device. The universal network interface device accepts peripheral inouts, formats these inputs into a message structure established by the link control protocol, and transmits the messages over the communication network. Conversely, it accepts messages from the network, determines if the message is to the subscriber or to go back on the network. The design of the universal network interface device was modularized to allow the device to be configured based upon the user local network requirements. GRA

N79-22770# Massachusetts Inst. of Tech., Cambridge.

ONE-POINT TOUCH INPUT OF VECTOR INFORMATION FOR COMPUTER DISPLAYS Progress Report, 22 Jul.

1977 - 31 Dec. 1978
Nicholas Negroponte, Christopher Herot, and Guy Weinzapfel Oct. 1978 23 p
(Grant DAHC19-77-G-0014; DA Proj. 2Q1-61102-B-74F)
(AD-A064278; ARI-TR-78-TH3) Avail: NTIS HC A02/MF A01 CSCL 09/02

The finger as a graphical stylus enjoys a coefficient of friction with glass sufficient to provide input of direction and torque as well as position from a single point. This report describes a pressure sensitive digitizer (PSD) capable of accepting these force inputs, and discusses a set of five simple input applications used to assess the capabilities of this device. These applications include techniques for specifying vectors, and pushing, pulling, dispersing and reorienting objects with a single touch. Experience gained from these applications demonstrates that touch and pressure sensing open a rich channel for immediate and multi-dimensional interaction. The project is an example of basic research with potential for future application. The report will be of interest primarily to research scientists in the field of graphic CRT displays. Author (GRA)

N79-22771# TRW Defense and Space Systems Group, Redondo Beach, Calif.
HIGH SPEED A/D CONVERTERS SYSTEMS APPLICATIONS STUDY Final Report
Aug. 1978 177 p refs
(Contract N00039-78-C-0057)
(AD-A063488; TRW-31891) Avail: NTIS HC A09/MF A01 CSCL 09/02

This report presents the results of a 6 month study of the Navy's present and future needs in high speed A/D converters, and the A/D converter technologies that have potential to fill those needs. System requirements are examined in communications, radar, optical/IR, EW/ELINT, and sonar systems. Generic requirements and specific systems are discussed along with projections to future system high speed A/D converter needs. Five A/D converter technologies, development requirements, and potential for satisfying the Navy's systems high speed A/D needs are examined. The technologies covered are: silicon bipolar, gallium arsenide FET, gallium arsenide TED/FET, Josephson junction, and electro-optical. The report concludes with a summary of the Navy's present and future needs in high speed A/D converters, and the potential and developmental requirements of the five A/D technologies. Recommendations are made for developments of A/D converters using existing technology and A/D technology developments. Author (GRA)

N79-22772# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
ENVIRONMENTAL SPECIFICATIONS FOR FIXED HEAD DISK STORAGE SYSTEMS IN NON-TACTICAL APPLICATIONS Final Report
Gordon P. Marques Nov. 1978 25 p refs
(TF53531001)
(AD-A063995; DTNSRDC/CMLD-78/14) Avail: NTIS HC A02/MF A01 CSCL 09/2

The purpose of this study was to investigate and develop minimal environmental and electromagnetic interference testing requirements that would insure normal survivability aboard ship for a fixed head mass storage disk system. These environmental and electromagnetic interference specifications are intended for units that will be used only in non-tactical applications. Minimal environmental and electromagnetic interference test requirements were developed. Two different manufacturers of commercially ruggedized fixed disk storage units lent the Navy their units for the purpose of evaluating the environmental and electromagnetic test requirements. These units were tested at a testing facility and the results are included in this report. The test results indicate that these proposed environmental and electromagnetic interference test requirements can be satisfied but that not all commercially ruggedized fixed head disk storage units can satisfy them. Author (GRA)

N79-22773# Questron Corp., San Diego, Calif.
RADIATION HARDENED MICROPROCESSOR TECHNOLOGY STUDY Final Technical Report, Jun. 1977 - Mar. 1978
J. P. Spratt and D. Z. Harbert Oct. 1978 117 p refs
(Contract F19628-77-C-0177)
(AD-A063902; RADC-TR-78-231) Avail: NTIS HC A06/MF A01 CSCL 18/6

This report discusses four LSI technologies-NMOS, TTL, CMOS and I2L-relative to their current and projected capabilities in both the commercial and the radiation hardened markets. The state-of-the-art in radiation hardened digital electronics is described along with a discussion of design techniques that may be used to apply LSI to hardened systems. Finally, a preliminary analysis of radiation testing of a microprocessor bit slice is provided. Author (GRA)

N79-22774# School of Aerospace Medicine, Brooks AFB, Tex.
A COMPUTERIZED OPTICAL SCAN DATA FORM GENERATOR Final Report, Jul. - Dec. 1978
John W. Slaughter and Richard L. Medina Dec. 1978 24 p
(AD-A064140; SAM-TR-78-34) Avail: NTIS HC A02/MF A01 CSCL 09/2

A system for generating OPSCAN readable data collection forms is described which enables free form design of computer input documents. The main component of the system is a Fortran IV program utilizing two subroutines from the CALCOMP Basic Software. A sample application with illustrations is provided. Author (GRA)

N79-22775# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MICROPROCESSOR BASED DATA ACQUISITION AND PROCESSING SYSTEM M.S. Thesis
Saleem Iftekhar Dec. 1978 238 p refs
(AD-A064728; AFIT/GE/EE/78-29) Avail: NTIS HC A11/MF A01 CSCL 09/2

The Air Force Flight Dynamics Laboratory at Wright-Patterson Air Force Base, Ohio, plans to design a constrained layer damping treatment for aircraft components. This design requires the knowledge of vibration and temperature variations that a component encounters in service. The development of a microprocessor based data acquisition and processing system (MIBDAPS) to monitor the vibration and temperature variations of a component under test is discussed in this paper. The designed system is capable of acquiring and processing data in real time and generating cumulative damage factor versus frequency and temperature contours. These contours are used in the design of the damping treatment. The system uses an LSI-11M microcomputer as its central processor. The support hardware for this microcomputer includes an analog-to-digital converter, core memory, real time clock, and serial line interface module. The software developed for this system handles the acquisition and processing of data. The real time processing includes the computation of the FFT and power spectrum of the vibration signal and subsequent calculation of the cumulative damage factor versus frequency and temperature contours. The bench model of the designed system was implemented and tested for functional performance. Author (GRA)

N79-22776# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN OF A SEL 86/LSI-11 INTERFACE MONITOR M.S. Thesis
Janet E. Baralli Dec. 1978 114 p refs
(AD-A064396; AFIT/GCS/EE/78-9) Avail: NTIS HC A06/MF A01 CSCL 09/2

The Air Force Materials Laboratory (AFML) uses LSI-11 microcomputers as one of several computer systems available for collecting test data. For conducting these tests, LSI-11 programs must be loaded into and data collected from the LSI-11 using paper tapes. Data is later stored on a larger computer system at AFML, the SEL 86. The purpose of this investigation has been to design a SEL 86/LSI-11 interface that will automate manual procedures. The interface design enhances the current LSI-11 system by providing the following capabilities: load binary programs and data residing on a SEL 86 file into LSI-11 memory; transmit data stored in LSI-11 memory to one or more SEL 86 files, and place the LSI-11 memory into a transparency mode such that it is a peripheral as viewed by the SEL 86. The principles of software engineering have been applied in both the analysis and design phases. Formal tools have been used in defining the requirements and developing the structured design. The resulting design is an interface monitor with software residing

on both the LSI-11 and the SEL 86. The added capabilities are provided using either a series of commands entered at the LSI-11 console or as call statements in LSI-11 FORTRAN compiled programs. Author (GRA)

N79-22777# General Research Corp., McLean, Va.
AUTOMATED PERSONNEL DATA BASE SYSTEM SPECIFICATIONS, TASK 5 Final Report
Hugh J. Bartley, Alexander K. Bocast, Francis O. Deppner, Oscar J. Harrison, and Irene W. Kraas Nov. 1978 157 p
(PB-291848/0; NUREG-CR-0045) Avail: NTIS HC A08/MF A01 CSCL 09B

Development of qualification requirements, training programs, career plans, and methodologies for effective management and training of inspection and enforcement personnel were studied. Task 5 required the development of an automated personnel data base system for NRC/IE. This system is identified as the NRC/IE Personnel, Assignment, Qualifications, and Training System (PAQTS). The documentation for PAQTS including the functional requirements document (FRD), the data requirements document (DRD), the hardware and software capabilities assessment, and the detailed implementation schedule are provided. GRA

N79-22778# General Accounting Office, Washington, D. C.
AUTOMATED SYSTEMS SECURITY: FEDERAL AGENCIES SHOULD STRENGTHEN SAFEGUARDS OVER PERSONAL AND OTHER SENSITIVE DATA Report to the Congress
Jan. 1979 87 p refs
(PB-291620/3; LCD-78-123) Avail: NTIS HC A05/MF A01 CSCL 09B

The status and effectiveness of automated systems security programs in the Federal Government is addressed in response to a request by the Chairman of the Subcommittee on Government Information and Individual Rights, House Committee on Government Operations. GRA

N79-22779# National Bureau of Standards, Washington, D. C. Inst. for Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: A METHODOLOGY FOR THE SELECTION OF INTERACTIVE COMPUTER SERVICES Final Report
Sandra A. Mamrak and Paul D. Amer Jan. 1979 86 p refs
(PB-291890/2; NBS-SP-500-44; LC-78-600149) Avail: NTIS HC A05/MF A01 CSCL 09B

This publication addresses the comparison and selection of remote access interactive computer services. The comparison methodology presented relies principally on the statistical analysis of measurement data obtained from the interaction between a computer service and a user. One of the most important properties of the methodology is that it incorporates confidence statements about the probability of having made a correct selection. Experimental data are presented to illustrate an application of the methodology, and serve as a basis for a discussion of the cost and appropriateness of using the methodology in various procurement efforts. GRA

N79-22780# Office of Management and Budget, Washington, D. C.
FEDERAL DATA PROCESSING REORGANIZATION STUDY: SCIENCE AND TECHNOLOGY TEAM REPORT Final Report
Louis W. Haire, Charles W. Cross, and Jesse H. Poore, Jr. Dec. 1978 61 p
(PB-291698/9) Avail: NTIS HC A04/MF A01 CSCL 09B

The current management of information technology by high technology agencies and causes of real or perceived problems are described. Viable options as solutions to those problems, and recommendations for improvement based on the options are identified. The role of the Federal Government in advancing the state-of-the-art in computer technology and the growth, fragmentation, and proliferation of Federal scientific and technical information systems and data bases is discussed. GRA

N79-22154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL A/D CONVERTER WITH AUTOMATIC DMA BLOCK-TRANSFER CAPABILITY
D. E. Wallis *In its* The Deep Space Network 15 Apr. 1979 p 85-94 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-22781 Brown Univ., Providence, R. I.
ON SPACE-TIME TRADEOFFS Ph.D. Thesis
Sowmitri Swamy 1978 130 p
Avail: Univ. Microfilms Order No. 7906616

A pebble game played on directed acyclic graphs as a model for studying space-time tradeoffs for straight-line programs is presented. These tradeoffs are generally expressed as hyperbolic functions in space and time with the number of inputs to the algorithm as a parameter. The number of pebbling moves, T, to compute the fast Fourier transform algorithm using S pebbles has bounds that differ by about a factor of 4, for large n. A linear recursion implementation that uses a stack of height n by a pebble game played on a directed acyclic graph of n vertices is reported. An analysis of the space-time tradeoff which determines the entire class of optimal algorithms for linear recursion for the entire range of values of space and time is discussed. For the class of straight-line algorithms a RAM computation that uses time T and Space S can be simulated by a TM in time and space. The significance of such transformations as it pertains to the idea that Space and Time are canonical parameters of computation is discussed. Dissert. Abstr.

N79-22782*# Illinois Inst. of Tech., Chicago.
PARS: PROGRAMS FOR ANALYSIS AND RESIZING OF STRUCTURES, USER MANUAL
R. T. Haftka, B. Prasad, and U. Tsach Apr. 1979 86 p refs
(Grant NsG-1266)
(NASA-CR-159007) Avail: NTIS HC A05/MF A01 CSCL 09B

PARS processors and their use, flutter analysis, sensitivity analysis for stresses, and resizing are presented. Design variable definition and interface with finite element model, static constraints and their derivatives, flutter derivatives, and optimization are discussed. S.E.S.

N79-22783*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION APPLIED TO RELIABILITY ANALYSIS OF RECONFIGURABLE, HIGHLY RELIABLE, FAULT-TOLERANT, COMPUTING SYSTEMS
Gerard E. Migneault Apr. 1979 13 p refs
(NASA-TM-80090) Avail: NTIS HC A02/MF A01 CSCL 09B

Emulation techniques are proposed as a solution to a difficulty arising in the analysis of the reliability of highly reliable computer systems for future commercial aircraft. The difficulty, viz., the lack of credible precision in reliability estimates obtained by analytical modeling techniques are established. The difficulty is shown to be an unavoidable consequence of: (1) a high reliability requirement so demanding as to make system evaluation by use testing infeasible, (2) a complex system design technique, fault tolerance, (3) system reliability dominated by errors due to flaws in the system definition, and (4) elaborate analytical modeling techniques whose precision outputs are quite sensitive to errors of approximation in their input data. The technique of emulation is described, indicating how its input is a simple description of the logical structure of a system and its output is the consequent behavior. The use of emulation techniques is discussed for pseudo-testing systems to evaluate bounds on the parameter values needed for the analytical techniques. S.E.S.

N79-22784# Martin Marietta Corp., Denver, Colo.
APPLICATION OF THE REPRESENTATION INDEPENDENT PROGRAMMING SYSTEM TO KNOWLEDGE MANAGEMENT Final Technical Report
C. Russell Spath and Lowell S. Schneider Dec. 1978 82 p refs
(Contract F30602-77-C-0142)

(AD-A064062; MCR-78-1404; RADC-TR-78-197) Avail: NTIS HC A05/MF A01 CSCL 09/2

Brief descriptions of the Representation Independent Programming System (RIPS) components are presented, and preliminary assignment of Knowledge Management (KW) functional requirements to these components are proposed and discussed. The majority of KM functions are found to correspond closely with RIPS concepts and present definitions. Extensions to RIPS to accomodate some KM functional requirements and current RIPS concepts that extend the KM requirements are discussed and are included in a final allocation matrix, defining the functional requirements of RIPS to satisfy KM requirements. The current status of RIPS components are discussed and estimates of time to develop a KM test-bed are provided along with a proposed schedule. Facility requirements for the development are listed and estimated performance characteristics, projected from current results, are provided. The powerful KM concepts are found to be satisfied by RIPS with few extensions and, in fact, to be enhanced beyond the explicit requirements. Implementation of the concepts in a test-bed environment is found to be feasible. Author (GRA)

N79-22785# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

GENERAL THEORY OF OPTIMAL ERROR ALGORITHMS AND ANALYTIC COMPLEXITY. PART B: ITERATIVE INFORMATION MODEL Interim Report

J. F. Traub and H. Wozniakowski Nov. 1978 97 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-22255)
(AD-A063757; CMU-CS-78-149-Pt-B) Avail: NTIS HC A05/MF A01 CSCL 12/1

This is the second of a series of papers in which an information based general theory of optimal error algorithms and analytic computational complexity and study applications of the general theory is constructed. In the first paper a general information model is studied; here an 'iterative information' model is studied. A general paradigm is given, based on the pre-image set of an information operator, for obtaining a lower bound on the error of any algorithm using this information. It is shown that the order of information provides an upper bound on the order of any algorithm using this information. This upper bound order leads to a lower bound on the complexity index. GRA

N79-22786# Pennsylvania Univ., Philadelphia. Dept. of Computer and Information Sciences.

VERIFICATION AND CORRECTION OF NON-PROCEDURAL SPECIFICATIONS IN AUTOMATIC GENERATION OF PROGRAMS Ph.D. Thesis

Subramanya K. Shastry 15 Sep. 1978 553 p refs
(Contract N00014-76-C-0416)
(AD-A063900; Rept-78-01) Avail: NTIS HC A24/MF A01 CSCL 09/2

This dissertation deals with the design and implementation of an interactive Automatic Program Generator, which will generate PL/1 programs from a nonprocedural description of a problem in MODEL (Module Description Language). MODEL has many characteristics of very high level languages, being at the same time, descriptive. MODEL processor is quite tolerant of errors in a user specification (like incompleteness, inconsistencies, and ambiguities), and resolves those errors, either by generating additional statements, or by updating the user supplied statements. A special form of graph called, Array Graph, is used to represent the MODEL specification. Informally, an array graph is a compact representation of a conventional directed graph. Conventional graph algorithms are applied directly to the array graphs, and in particular, a necessary and sufficient condition for sequenceability of array graphs is derived. Array graph representation has been found quite useful in analyzing MODEL specifications consisting of iterations and recursions. Author (GRA)

N79-22787# Wisconsin Univ. - Madison. Mathematics Research Center.

A UNIFIED PARAMETRIC QUADRATIC PROGRAMMING SOLUTION TO SOME STOCHASTIC LINEAR PROGRAMMING MODELS

Masakazu Kojima and Ikuyo Kaneko Nov. 1978 22 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A064039; MRC-TSR-1893) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper, deterministic models for a stochastic linear program with a constant feasible region and stochastic cost coefficients having multi-variate normal distribution are considered. Relationships among the solutions of these models are examined and it is shown that solving a parametric quadratic program associated with Markowitz's mean-variance model yields solutions to all other models considered for all relevant values of parameters. Author (GRA)

N79-22788# Wisconsin Univ. - Madison. Mathematics Research Center.

AN EFFICIENT WEAK LINE SEARCH WITH GUARANTEED TERMINATION

M. R. Osborne Aug. 1978 13 p refs
(Contract DAAG29-75-C-0024)
(AD-A063969; MRC-TSR-1870) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method based on repeated quadratic interpolation is proposed for satisfying a weak line search criterion given by A. A. Goldstein and it is shown to be efficient and to have quaranteed termination. An extension of the line search criterion appropriate to minimum norm problems is sketched. Author (GRA)

N79-22789# Wisconsin Univ. - Madison. Mathematics Research Center.

ON THE VALIDITY OF A NONLINEAR PROGRAMMING METHOD FOR SOLVING MINIMAX PROBLEMS

Shih-Ping Han Oct. 1978 14 p refs
(Contract DAAG29-75-C-0024)
(AD-A063984; MRC-TSR-1891) Avail: NTIS HC A02/MF A01 CSCL 12/1

We consider the minimization of a function which is the maximum of a finite number of smooth but nonlinear functions. It is well-known that the minimax problem of this type connects naturally to a nonlinear program. Through this connection the effective quasi-Newton method becomes applicable. We show that this approach is valid and the resulting method has global convergence properties. Author (GRA)

N79-22790# Wisconsin Univ. - Madison. Mathematics Research Center.

STRONGLY REGULAR GENERALIZED EQUATIONS

Stephen M. Robinson Sep. 1978 36 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-74-20584)
(AD-A064030; MRC-TSR-1877) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers generalized equations, which are convenient tools for formulating problems in complementarity and in mathematical programming, as well as variational inequalities. A regularity condition for such problems is introduced and, with its help, proves existence, uniqueness and Lipschitz continuity of solutions to generalized equations with parametric data. Applications to nonlinear programming and to other areas are discussed, and for important classes of such applications the regularity condition given here is shown to be in a certain sense the weakest possible condition under which the stated properties will hold. Author (GRA)

N79-22791# Wisconsin Univ. - Madison. Mathematics Research Center.

EXACT PENALTY FUNCTIONS IN NONLINEAR PROGRAMMING

S.-P. Han and O. L. Mangasarian Nov. 1978 28 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-74-20584)
(AD-A063998; MRC-TSR-1897) Avail: NTIS HC A03/MF A01 CSCL 12/2

It is shown that the existence of a strict local minimum satisfying the constraint qualification of Mangasarian and Fromovitz or McCormick's second order sufficient optimality condition implies the existence of a class of exact local penalty functions (that is ones with a finite value of the penalty parameter) for a nonlinear programming problem. A lower bound to the penalty parameter is given by a norm of the optimal Lagrange multipliers which is dual to the norm used in the penalty function. GRA

N79-22792# Softech, Inc., Waltham, Mass.
HOL INVESTIGATION Final Technical Report, Jun. 1976 - Sep. 1978
James L. Felty, John R. Kelly, John B. Goodenough, and Lawrence H. Shafer Griffiss AFB, N. Y. RADC Jan. 1979 57 p
(Contract F30602-76-C-0306; AF Proj. 2022)
(AD-A064749; RADC-TR-78-269) Avail: NTIS HC A04/MF A01 CSCL 09/2

The HOL investigation was a two year effort to determine communications high-order language requirements and define modifications to an existing language to be suitable for these requirements. Modifications to the JOVIAL J73/I programming language have been described as well as a SEMANOL formal specification of the modified language. Author (GRA)

N79-22793# Navy Personnel Research and Development Center, San Diego, Calif.
USER PERFORMANCE WITH A NATURAL LANGUAGE QUERY SYSTEM FOR COMMAND CONTROL Interim Report
Ramon L. Hershman, Richard T. Kelly, and Harold G. Miller Jan. 1979 54 p refs
(ZF5551019)
(AD-A064695; NPRDC-TR-79-7) Avail: NTIS HC A04/MF A01 CSCL 09/2

Natural language query systems have been developed as potential aids to command control data retrieval processes involving large data bases. One such system, LADDER (for Language Access to Distributed Data with Error Recovery), was studied in order to identify significant performance characteristics associated with its use in a Navy command control environment. Ten officers received moderate training in LADDER and subsequently employed it in a search and rescue scenario. Both system and user performance were examined. Basic patterns of usage were established, and troublesome syntactic expressions were identified. Design recommendations for the man-computer interface in command control query systems are discussed. Author (GRA)

N79-22794# Federal COBOL Compiler Testing Service, Washington, D. C.
FORTRAN COMPILER VALIDATION SUMMARY REPORT
1979 17 p
(AD-A064668; FCCTS/FCVS66-VSR350) Avail: NTIS HC A02/MF A01 CSCL 09/2

The purpose of the Validation Summary Report (VSR) is to identify individual FORTRAN language elements whose implementation does not conform to the language specifications defined in American Standard FORTRAN, X3.9-1966. GRA

N79-22795# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
ERROR RECOVERY IN CAPABILITY SYSTEMS
William A. Wulf and Didier Lanciaux Jun. 1978 27 p refs
(Contract F44620-73-C-0074)
(AD-A064794; CMU-CS-78-127; AFOSR-79-0061TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

Methodologies and checking techniques have been proposed to improve software reliability. It has also been argued that capability mechanisms are the natural support for these techniques because they enhance modular decomposition and information hiding. However, there is a conflict between these observations; modular decomposition limits the possible recovery actions to the information that a module can access directly. Each module must rely upon the reliability of those that it uses. This paper presents a mechanism which allows recovery to be managed at any level in this system while satisfying the information hiding principle. It is based on a save-restore mechanism. In addition, primitives to define consistent states in the system are provided by the Kernel. Author (GRA)

N79-22796# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE SYMBOLIC MANIPULATION OF COMPUTER DESCRIPTIONS: AN INTRODUCTION TO ISPS
Mario R. Barbacci 16 Aug. 1978 24 p
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A064793; CMU-CS-78-137; AFOSR-79-0069TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report introduces the reader to ISPS notation. Although some details have been excluded, it covers enough of the language to provide a 'reading' capability. Thus while this document in itself might not be sufficient to allow writing ISPS descriptions, it should be detailed enough to permit the reading and study of complex descriptions. Not all the features of the notation are presented in the examples. For a detailed explanation of the complete language the reader must consult the reference manual. The ISPS Computer Description Language is available from Departments of Computer Science and Electrical Engineering, Carnegie-Mellon Universtiy. There exists a compiler and simulator for ISPS. These programs are written in BLISS-10 and run on a DEC PDP-10 Computer under either TOP-10, TOPS-20, or TENEX. Author (GRA)

N79-22797# Honeywell, Inc., Hopkins, Minn. Defense Systems Div.
FURTHER DEVELOPMENT OF THE EPIC-3 COMPUTER PROGRAM FOR THREE-DIMENSIONAL ANALYSIS OF INTENSE IMPULSIVE LOADING Final Report, Apr. 1977 - Apr. 1978
Gordon R. Johnson, Dwight D. Colby, and Daniel J. Vavrick Eglin AFB, Fla. AFATL Jul. 1978 116 p refs
(Contract F08635-77-C-0121; AF Proj. 2307)
(AD-A064522L; AFATL-TR-78-81; HONEYWELL-47324) Avail: NTIS HC A06/MF A01 CSCL 19/4

An advanced version of the EPIC-3 computer program is described. The numerical technique is based on a Lagrangian finite element formulation where the equations of motion are integrated directly rather than through the traditional stiffness matrix approach. It is primarily intended for three dimensional analysis of penetration and wave propagation problems resulting from high velocity impact, although other applications are possible. The two most significant improvements over the initial version of the EPIC-3 code, are that problems of unlimited size can be run and that the code is programmed to eventually run on fourth generation vector computers. Other improvements include the capability to apply external pressures, reduction of required input, expanded geometry generators, a more general sliding surface capability and expanded plotting capability. Author (GRA)

N79-22798# Polytechnic Inst. of New York, Brooklyn. Dept. of Electrical Engineering and Electrophysics.
ON THE NUMBER OF TESTS NECESSARY TO VERIFY A COMPUTER PROGRAM Interim Report, Jan. 1978 - Aug. 1978
G. S. Popkin and M. L. Shooman Griffiss AFB, N. Y. RADC Nov. 1978 73 p refs
(Contract F30602-78-C-0057; AF Proj. 2304)
(AD-A065004; POLY-EE78-047; RADC-TR-78-229) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report discusses the use of flowchart graphs, adjacent matrices, and zero-one linear programming to find the minimum number of tests necessary to execute every segment of a computer program at least once. The methods of Lipow are used as the basis for determining the maximum incomparable set, i.e., the largest set of program segments through which one and only one test case should pass. The size of the maximum incomparable set gives the minimum number of tests necessary to execute each segment at least once, while the elements of this set give the paths of each test. The report develops methods for finding the maximum incomparable set for loopless and some elementary looping flowcharts. Author (GRA)

N79-22799# Computer Corp. of America, Cambridge, Mass.
PROGRAM LISTINGS FOR SWF-D: THE SIGNAL WAVEFORM FILE DEMON
Joanne Z. Sattley 31 Jan. 1979 133 p refs
(Contract N00039-78-C-0246; ARPA Order 3540)
(AD-A064989; CCA-79-10) Avail: NTIS HC A07/MF A01 CSCL 09/2

This document contains listings of the SWF-D program source-code and data definitions. The source-code is divided into sections, each of which represents a separately compiled program module and, to facilitate referencing, subsection numbers have been assigned to several of the more interesting routines within

the modules. Global data definitions, constants and variables are listed in the Appendix. GRA

N79-22800# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
USER'S GUIDE TO ANYOLS: A REGRESSION PROGRAM ALLOWING MANY WAYS TO SELECT A MODEL
C. L. Atwood Mar. 1978 33 p refs
(Contract EY-76-C-07-1570)
(RE-A-78-049) Avail: NTIS HC A03/MF A01

Program package ANYOLS allows the user to fit one or more ordinary least squares regression models in a stepwise or predetermined way. Possible stepwise selection criteria are: F, s to the second power, MSE (from C/sub p/) and PRESS. Possible predetermined ways are to get all possible regressions and to get all possible regressions which include the first variable. Other ways may be specified by a user-written subroutine. User control of input, variable selection criteria and output is through short user-written FORTRAN subroutines. DOE

N79-22801# National Bureau of Standards, Washington, D. C. Mathematics Analysis Div.
A UNIVERAL SET OF TEST DATA FOR COMPUTER IMPLEMENTATIONS OF ELEMENTARY MATHEMATICAL FUNCTIONS Final Report
Daniel W. Lozier May 1978 30 p refs
(PB-291961/1; NBSIR-78-1478) Avail: NTIS HC A03/MF A01 CSCL 09B

A short table of values of 20 mathematical functions commonly found in computer libraries is given. The data was chosen to sample the functions throughout the range of a typical floating point arithmetic. Computer implementations can be tested by comparing computed function values against the tabular values. A discussion on how to interpret the test results is included, for both decimal and non-decimal implementations. GRA

N79-22802# National Bureau of Standards, Washington, D. C. Inst. for Computer Sciences and Technology.
FINDINGS OF THE STANDARD BENCHMARK LIBRARY STUDY GROUP Final Report
Dennis M. Conti Jan. 1979 72 p refs
(PB-291779/7; NBS-SP-500-38; LC-78-606168) Avail: NTIS HC A04/MF A01 CSCL 09B

The technical feasibility of the standard benchmark library concepts was investigated. Implementation, maintenance, cost/benefit, and acceptability of standard benchmarks are among the factors studied. It was found that a technical foundation had not yet been established for addressing several fundamental questions in all phases of the benchmark process. Therefore, recommendations for further work are given. GRA

N79-22803# National Bureau of Standards, Washington, D. C. Inst. for Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: A SURVEY OF REMOTE MONITORING Final Report
Gary J. Nutt Jan. 1979 40 p refs
(Contract NBS-7-35839)
(PB-291768/0; NBS-SP-500-42; LC-78-26313) Avail: NTIS HC A03/MF A01 CSCL 09B

Remote monitoring in the application areas of performance evaluation, diagnostic testing, performance evaluation, diagnostic testing, performance assurance, and system security testing is described. The evolution of remote monitors are categorized into seven classes. Several e systems are discussed for each classification, along with their capabilities in each application area. GRA

N79-22804# Gass (Saul I.), Potomac, Md.
COMPUTER SCIENCE AND TECHNOLOGY. COMPUTER MODEL DOCUMENTATION: A REVIEW AND AN APPROACH Final Report
Saul I. Gass Feb. 1979 95 p refs
(PB-291767/2; NBS-SP-500-39; LC-78-606146) Avail: NTIS HC A05/MF A01 CSCL 09B

The issues and concerns of computer model documentation and an approach for the development of adequate documentation are described. A number of documents are reviewed, including software documentation guidelines and model documentation procedures. Based on the relationship between the phases of the model life cycle and documentation information needs, a set of documents is proposed. An extreme position as to the total information and number of documents required to produce adequate documentation was recommended. All information generated during a model's life cycle was calculated. GRA

N79-22142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DSN PROGRAMMING SYSTEM
A. P. Irvine *In its* The Deep Space Network 15 Apr. 1979 p 4-6 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N79-22153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UNATTENDED OPERATIONS SOFTWARE SYSTEMS DESIGN Progress Report
L. Lim *In its* The Deep Space Network 15 Apr. 1979 p 78-84 (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N79-22157*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EFFICIENT SOFT DECISION DECODING ALGORITHM FOR BLOCK CODING
H. J. Greenberger *In its* The Deep Space Network 15 Apr. 1979 p 106-109 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N79-22805*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOME PRACTICAL UNIVERSAL NOISELESS CODING TECHNIQUES
Robert F. Rice 15 Mar. 1979 132 p refs
(Contract NAS7-100)
(NASA-CR-158515; JPL-PUB-79-22) Avail: NTIS HC A07/MF A01 CSCL 09B

Some practical adaptive techniques for the efficient noiseless coding of a broad class of such data sources are developed and analyzed. Algorithms are designed for coding discrete memoryless sources which have a known symbol probability ordering but unknown probability values. A general applicability of these algorithms to solving practical problems is obtained because most real data sources can be simply transformed into this form by appropriate preprocessing. These algorithms have exhibited performance only slightly above all entropy values when applied to real data with stationary characteristics over the measurement span. Performance considerably under a measured average data entropy may be observed when data characteristics are changing over the measurement span. S.E.S.

N79-22806# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
SIMPLE MODELS IN STOCHASTIC PRODUCTION PLANNING
Suresh P. Sethi (Toronto Univ.) and Gerald L. Thompson Jul. 1978 17 p refs Sponsored in part by Natl. Res. Council of Can.
(Contract N00014-75-C-0621)
(AD-A064346; MSRR-420; WP-3-78-79) Avail: NTIS HC A02/MF A01 CSCL 15/5

A simple stochastic production-inventory model with quadratic

cost functions is analyzed in detail. The inventory process is assumed to be driven by a white noise process resulting into an Ito stochastic differential equation. Both finite and infinite horizon versions of the problem are treated by a methodology based on the theory of stochastic integrals and differentials. Particular attention is given to illustrate the methodology, which is quite general and capable of dealing with more complicated problems. The paper concludes with some remarks in connection with the relationship of the results of this paper to the results in the deterministic case. Author (GRA)

N79-22807# Naval Research Lab., Washington, D. C. Communications Sciences Div.

MINIMUM CROSS-ENTROPY SPECTRAL ANALYSIS Interim Report

John E. Shore 16 Jan. 1979 36 p refs
(RR0140941)
(AD-A064183; AD-E000261; NRL-MR-3921) Avail: NTIS HC A03/MF A01 CSCL 09/4

The principle of minimum cross-entropy (minimum directed divergence) is summarized, discussed, and applied to the classical problem of estimating power spectra given samples of the autocorrelation function. This new approach reduces to maximum entropy spectral analysis (MESA) in certain special cases, and thereby provides a fundamental derivation of MESA. In contrast to MESA, the minimum cross-entropy approach makes use of prior information about the power spectrum. Depending on the extent of prior information, various alternative minimum cross-entropy spectral estimates are obtained. When a prior estimate of the power spectrum is available, the minimum cross-entropy result differs from the MESA result. Results are derived in two equivalent ways; once by minimizing the cross-entropy of underlying probability densities, and once by arguments concerning the cross-entropy between the input and output of linear filters. GRA

N79-22808# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN INTERACTIVE ANALYSIS PROGRAM FOR A DIGITAL IMAGE PROCESSING LABORATORY M.S. Thesis

Dennis A. McGaugh Sep. 1978 75 p refs
(AD-A064193; AFIT/GE/EE/78S-16) Avail: NTIS HC A04/MF A01 CSCL 09/4

A FORTRAN program is presented that will interactively prepare digitized images (pictures) for experimental analysis. The digital preparation includes the ability to Discrete Fourier Transform (DFT), Inverse Fourier Transform (IDFT), threshold image power spectral density, and to perform two-dimensional image filtering. Further, a brief discussion of image distortion measurements, optimal image size for experimental presentation, and image aliasing is provided. A sample of typical processed image results is also supplied. Author (GRA)

N79-22809# Center for Naval Analyses, Arlington, Va.

A NEW LOOK AT THE RELATION BETWEEN INFORMATION THEORY AND SEARCH THEORY

John G. Pierce Jun. 1978 69 p refs
(Contract N00014-76-C-0001)
(AD-A063845; CRC-357) Avail: NTIS HC A04/MF A01 CSCL 09/4

Some apparent contradictions in the operations research literature of search theory and information theory are reviewed, and the source of the conflict is isolated. The information processes connected with a search operation are examined by studying the geometric properties of information surfaces in search-allocation space. Some new theorems are developed which show that the connection between search and information theory is much stronger than previously believed. It is demonstrated that the amount of search effort, C, is a critical parameter in the relation between search and information gain. For very small values of C, there is no unique relation between detection probability and information gain; for very large values of C, the optimal whereabouts search policy produces the greatest information gain; for a broad intermediate range of C (including many cases of practical interest) the optimal detection search policy produces the greatest information gain. Author (GRA)

N79-22810# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

A NEW ERROR MODEL FOR DISCRETE SYSTEMS AND ITS APPLICATION TO ADAPTIVE IDENTIFICATION AND CONTROL

Yuan-Hao Lin and Kumpati S. Narendra Oct. 1978 17 p refs
(Contract N00014-76-C-0017)
(AD-A063930; S/IS-7802) Avail: NTIS HC A02/MF A01 CSCL 12/1

A new error model for discrete adaptive systems is presented in this paper. By introducing a feedback term in the corresponding error model for the continuous case it is found possible to retain the same form for the adaptive laws. It is demonstrated that the output error tends to zero whether or not the input vector is bounded. The new error model has wide applications in both adaptive identification and adaptive control. Two applications are outlined towards the end of the paper to indicate how the error model is derived and the corresponding adaptive laws generated. Author (GRA)

N79-22811# Wisconsin Univ. - Madison. Mathematics Research Center.

SHADOW PRICES, DUALITY AND GREEN'S FORMULA FOR A CLASS OF OPTIMAL CONTROL PROBLEMS

J. P. Aubin and F. H. Clarke Nov. 1978 26 p refs Sponsored in cooperation with Natl. Res. Council of Can.
(Contract DAAG29-75-C-0024)
(AD-A064001; MRC-TSR-1900) Avail: NTIS HC A03/MF A01 CSCL 12/1

A class of optimal control problems is considered in which the cost functional is locally Lipschitz (not necessarily convex or differentiable) and the dynamics linear and/or convex. By using generalized gradients and duality methods of functional analysis, necessary conditions are obtained in which the dual variables admit interpretation as shadow prices (or rates of change of the value function). Applications are presented in three settings: infinite horizon optimal control, optimal control of partial differential equations, and a variational problem with unilateral state constraints. A theorem is proved which characterizes the generalized gradients of integral functionals on L(p). Author (GRA)

N79-22812# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A DEVELOPMENT SYSTEM FOR MICROPROCESSOR BASED PATTERN RECOGNIZERS, VOLUME 1 M.S. Thesis

John R. Leary Dec. 1978 177 p refs
(AD-A064194; AFIT/GCS/EE/78-12-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 05/8

A tool for developing microprocessor based pattern recognizers is presented. A two segment system of programs is implemented. One segment is a subsystem consisting of a generalized pattern classifier program and utility routines for an INTEL SBC 80/20 microprocessor system. The other segment is a subsystem of four interactive programs. These four programs support feature selection, pattern class definition and performance evaluation using procedures fitted to the classifier algorithm. This subsystem operates on a user supplied file of feature vectors. It froduces a class defining structure for use by the classifier. It can use a TEKTRONIX 4014 for graphics support and will operate interactively within the CDC 6600 Intercom partition. Structured design, modular code, buffer allocation algorithms, and ANSI standard FORTRAN code make this segment transportable. The classifier segment requires an 8080 system. Less than 256 bytes of ROM are used. Data buffer locations and sizes, the number of classes and the number of features are specified by the user. Experiments produced estimates of classifier performance for this system. An error rate of less than ten percent is reported for one 26 class character recognition experiment. Author (GRA)

N79-22813# Lincoln Lab., Mass. Inst. of Tech., Lexington.

A METHOD FOR IDENTIFYING DIFFERENCES BETWEEN TWO CLASSES

Nathan E. Lindgren 29 Nov. 1978 35 p refs
(Contract F19628-78-C-0002)
(AD-A064724; TN-1978-38; ESD-TR-78-296) Avail: NTIS HC A03/MF A01 CSCL 12/1

A non-parametric measure of the difference between sample distributions of a random variable for two classes of data is presented. The method involves counting the number of class reversals among the ordered set of two class data and provides a normalized measure of class intermingling. Applications of the method to the discrimination-feature selection problem are described. Author (GRA)

N79-22814# Maryland Univ., College Park. Computer Vision Lab.
MEASUREMENT OF THE LENGTHS OF DIGITIZED CURVED LINES Interim Report
T. J. Ellis (Chelsea Coll.), D. Profitt (Chelsea Coll.), Dennis Rosen, and W. Rutkowski Sep. 1978 32 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A064823; TR-697; AFOSR-79-0050TR) Avail: NTIS HC A03/MF A01 CSCL 05/8

An examination is made of methods of measuring the lengths of arbitrarily shaped smooth curves from their quantized representations, both in the absence and in the presence of noise. For 4-way encoded curves in the absence of noise, the length of the underlying smooth curve can be accurately assessed as a constant multiplied into n, the number of direction vectors in the curve, or as a function of n and the number of corners in the curve. Good measurements can also be obtained in the presence or absence of noise by means of an m-step polygon measure, or after direction or curvature smoothing. The methods are explained and their merits are compared. Author (GRA)

N79-22815# Science Applications, Inc., Arlington, Va.
IMAGE UNDERSTANDING Semiannual Technical Report, May - Nov. 1978
Lee S. Baumann Nov. 1978 208 p refs Proc. of workshop held at Pittsburgh, Pa., 14-15 Nov. 1978
(Contract MDA903-78-C-0095; DARPA Order 3456)
(AD-A064765; SAI-79-814-WA) Avail: NTIS HC A10/MF A01 CSCL 09/2

This document contains the technical papers and outlines of semi-annual progress reports presented by the research activities in Image Understanding sponsored by the Information Processing Techniques Office, Defense Advanced Research Projects Agency. The papers were presented at a workshop conducted on 14-15 November 1978 in Pittsburgh Pennsylvania. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-22816 State Univ. of New York at Stony Brook.
COMMUTATORS OF HYPERBOLIC MOTIONS Ph.D. Thesis
James Dennis Basile 1978 68 p
Avail: Univ. Microfilms Order No. 7908636

The following problem is solved: given two hyperbolic motions A and M is there a third motion B such that the commutator of A and B is M? Given A and M in SL(2,C) exhibit necessary and sufficient conditions are shown for an element B to exist such that the commutator of A and B is M. Moreover, if one such element exists there is, in fact, a whole family of such elements. Dissert. Abstr.

N79-22817 Pennsylvania Univ., Philadelphia.
VECTOR BUNDLES ON NUMBER FIELDS Ph.D. Thesis
Paul Dana Cole 1978 121 p
Avail: Univ. Microfilms Order No. 7908718

The notion of vector bundles over a finite extension of the rational number field was studied. The analogy between function fields for curves over a finite field and number fields, and adelic methods were used. A rank r vector bundle over a number field was defined by using the adeles of GL sub r - the bundles turn out to be elements of a double coset space of GL sub r (A sub K). Bundles of fixed rank and certain other fixed invariants (their scale and volume) were studied. These subsets are finite for each number field k. When the rank of the bundles is two and the base field is totally real, the behavior of the number of such bundles was examined in an Iwasawa tower of l-cyclotomic extensions of the base field k. The notion of stability was defined and a formula was given counting the number of stable bundles in the nth stage of the tower, K sub n, in terms of the fixed invariants of the bundle and the relative class number of K sub n i over its maximal real subfield. Dissert. Abstr.

N79-22818 Pennsylvania Univ., Philadelphia.
INDEX FORMS AND POWER BASES FOR CYCLIC CUBIC FIELDS Ph.D. Thesis
James Gerald Huard 1978 43 p
Avail: Univ. Microfilms Order No. 7909083

A cyclic cubic field K(c,d) is determined by its conductor m with decomposition 4m = c square + 27d square. For I = I the set of integers M is characterized for which (*) is solvable (mode M) and thereby obtain necessary conditions for K(c,d) to have a power basis. If I is the index of some integer in K(c,d), then I/C and I/D are cubic residues (mode q) for every prime divisor q of the conductor m. By choosing values of u and v in (*) that are relatively prime and or opposite parity, a Diophantine equation is obtained that is always solvable for c and d. Given certain conditions on I (for example, I = 1) many fields are infinitely obtained K(c,d) that contain an integer of index I. Finally, the contrasting result that the minimal index is unbounded as K ranges over the set of cyclic cubic fields is proved. Dissert. Abstr.

N79-22819*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
NONLINEAR TRANSIENT ANALYSIS VIA ENERGY MINIMIZATION
Manohar P. Kamat and Norman F. Knight, Jr. (George Washington Univ. Center, Hampton, Va.) Oct. 1978 39 p refs Backup document for AIAA Journal in Aug. 1979
(Grant NGR-47-004-014)
(NASA-CR-158494) Avail: NTIS HC A02/MF A01 CSCL 12A

The formulation basis for nonlinear transient analysis of finite element models of structures using energy minimization is provided. Geometric and material nonlinearities are included. The development is restricted to simple one and two dimensional finite elements which are regarded as being the basic elements for modeling full aircraft-like structures under crash conditions. The results indicate the effectiveness of the technique as a viable tobl for this purpose. S.E.S.

N79-22820# SKF Industries, Inc., King of Prussia, Pa. Technology Services Div.
TWO-WAY ANALYSIS OF VARIANCE FOR WEIBULL POPULATIONS Final Report
John I. McCool Dec. 1978 48 p refs
(Contract F49620-77-C-0007; AF Proj. 2304)
(AD-A064585; SKF-AL78P046; AFOSR-79-0007TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Techniques and software are developed for the analysis of experiments in which the response variable follows the two-parameter and three-parameter Weibull distribution. For the two-parameter case the analogue of the analysis of variance is considered in which the hypothesis that the scale parameter is affected by the levels of an external factor is tested by a shape parameter ratio test. The analogue of Weibull regression is also treated for the case where the scale parameter varies as a power function of a quantitative external factor. A new method is found for drawing inferences on the location parameter of the three-parameter Weibull model, based on maximum likelihood shape parameter estimates. The sample sizes and censoring numbers for which empirical distribution have been determined are summarized. A summary is given of the software developed. Several applications of the techniques are also summarized. Author (GRA)

N79-22821# Brown Univ., Providence, R. I. Center for Dynamical Systems.
INVARIANTS AND CANONICAL FORMS UNDER FEEDBACK Interim Report
P. L. Falb and W. A. Wolovich 22 May 1979 50 p refs
(Grant AF-AFOSR-3182-77; AF Proj. 2304)

(AD-A064775; LCDS-78-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with the development of a complete set of invariants and canonical forms under feedback for linear systems characterized by proper rational transfer matrices. The invariants are determined in the frequency domain and consist of the Kronecker set of controllability indices together with a canonical form for the numerator of the transfer matrix under the action of a stabilizer subgroup of the unidoular group of polynomial matrices. Techniques used are algebro-geometric in nature. Author (GRA)

N79-22822# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

ROUND-OFF ERROR ANALYSIS OF A NEW CLASS OF CONJUGATE GRADIENT ALGORITHMS **Interim Report**

H. Wozniakowski Dec. 1978 37 p refs Presented at the Gatlinburg 7th meeting, Asilomar, Calif., Dec. 1977

(Contract N00014-76-C-0370; Grant NSF MCS-75-22255)

(AD-A064293; CMU-CS-78-153) Avail: NTIS HC A03/MF A01 CSCL 12/1

We perform the rounding error analysis of the conjugate gradient algorithms for the solution of a large system of linear equations Ax = b where A is an hermitian and positive definite matrix. We propose a new class of conjugate gradient algorithms and prove that in the spectral norm the relative error of the computed sequence (x sub k) (in floating point arithmetic) depends at worst on zeta eta to the 3/2 power where zeta is the relative computer precision and eta is the condition number of A. We show that the residual vectors r sub k - Ax sub k-b are at worst of order eta (A) abs. val. x sub k. We point out that with iterative refinement these algorithms are numerically stable. If zeta eta-squared is at most of order unity, then they are also well-behaved. Author (GRA)

N79-22823# Wisconsin Univ. - Madison. Mathematics Research Center.

FINITE ELEMENTS AND VARIATIONAL INEQUALITIES

R. Glowinski Oct. 1978 57 p refs

(Contract DAAG29-75-C-0024)

(AD-A064035; MRC-TSR-1885) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this report we consider the various problems related to the numerical analysis of elliptic variational inequalities. After proving some abstract results concerning the approximation of variational inequalities, we consider the approximation of some specific examples by conforming and non conforming finite element methods. Various iterative methods of solution are also described. Author (GRA)

N79-22824# Wisconsin Univ. - Madison. Mathematics Research Center.

EQUIVALENCE OF LINEAR COMPLEMENTARITY PROBLEMS AND LINEAR PROGRAMS IN VECTOR LATTICE HILBERT SPACES

C. W. Cryer and M. A. H. Dempster (Oxford Univ.) Oct. 1978 34 p refs

(Contract DAAG29-75-C-0024; Grant NSF MCS-77-26732)

(AD-A063982; MRC-TSR-1889) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let X be a vector lattice Hilbert space with dual X^*. Let M be a continuous linear mapping of X onto X^*. Let p, q elements of X^* with p = Or 0. Consider the relationship between the linear complementarity problem: Find x elements of X such that x = or − 0, Mx - q = or − 0, (x, Mx - q) − 0, and the linear programming problem: Find x element of X which minimizes (x,p) subject to = or − 0, Mx - q = or − 0. Author (GRA)

N79-22825# Wisconsin Univ. - Madison. Mathematics Research Center.

NUMERICAL APPROXIMATION OF A CAUCHY PROBLEM FOR A PARABOLIC PARTIAL DIFFERENTIAL EQUATION

Richard E. Ewing and Richard S. Falk Nov. 1978 26 p refs

(Contract DAAG29-75-C-0024; Grants DAAG29-78-G-0161; NSF MCS-78-09525; NSF MCS-78-02737)

(AD-A064041; MRC-TSR-1898) Avail: NTIS HC A03/MF A01 CSCL 12/1

In many physical problems in heat conduction, it is impossible to obtain an initial temperature distribution within a material. In many of these cases, in order to obtain approximations of the temperature within the body, one must rely entirely upon data which can be measured at the boundary. An additional problem is that these boundary data are only accurate to within some prescribed measurement errors. The purpose of this paper is to define a procedure for numerically approximating the solution of one such heat flow problem and to present explicit error estimates for the numerical procedure. A priori error estimates are presented when the data are known only approximately. GRA

N79-22826# Wisconsin Univ. - Madison. Mathematics Research Center.

A CONSTRUCTIVE APPROACH TO KERGIN INTERPOLATION IN R(k)

Charles A. Micchelli Nov. 1978 15 p refs

(Contract DAAG29-75-C-0024)

(AD-A063996; MRC-TSR-1895) Avail: NTIS HC A02/MF A01 CSCL 12/1

Very little seems to be known about polynomial interpolation of multivariate functions. However, Kergin recently established the existence and uniqueness of a natural extension of univariate interpolation to a multivariate setting. In this paper we provide a formula for Kergin interpolation. This formula is based on the Newton form for univariate polynomial interpolation. The error in approximating by Kergin interpolation is also obtained in a convenient form which allows us to assess the quality of this scheme. In particular, we establish that Kergin interpolation converges for analytic functions of several variables. GRA

N79-22827# Wisconsin Univ. - Madison. Mathematics Research Center.

EXPLOITING STRUCTURE IN FIXED-POINT COMPUTATION

Michael J. Todd Aug. 1978 30 p refs

(Contract DAAG29-75-C-0024; Grant NSF ENG-76-08749)

(AD-A063965; MRC-TSR-1867) Avail: NTIS HC A03/MF A01 CSCL 12/1

We consider the recent algorithms for computing fixed points of zeros of continuous functions from R to the nth power to itself that are based on tracing piecewise-linear paths in triangulations. We investigate the possible savings that arise when these fixed-point algorithms with their usual triangulations are applied to computing zeros of functions f with special structure: f is either linear in certain variables, separable, or has Jacobian with small bandwidth. Each of these structures leads to a property we call modularity; the algorithmic path within a simplex can be continued into an adjacent simplex without a function evaluation or linear programming pivot. Modularity also arises without any special structure on f from the linearity of the function that is deformed to f. GRA

N79-22828# Maryland Univ., College Park. Computer Science Center.

ESTIMATING CONDITION NUMBERS: AN EMPIRICAL STUDY

G. W. Stewart Nov. 1978 35 p refs

(Contract N00014-76-C-0391; Grant NSF MSC-76-03297)

(AD-A063864; CSC-TR-712) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper investigates two proposed methods for estimating the condition number of a matrix from factorizations commonly used to solve linear systems. One method estimates the condition number with respect to the 1-norm from the LU factorization, and the other the condition number with respect to the 2-norm from the QR factorization. Random matrices of various orders having known distributions of singular values were generated and the estimated condition numbers compared with the true ones. For the classes of matrices tested in this study, the estimators performed rather well, never underestimating the condition number by a factor of more than ten. The paper also gives an efficient method for generating random orthogonal matrices with the Haar distribution. Author (GRA)

N79-22829# Wisconsin Univ. - Madison. Mathematics Research Center.

GLOBAL SOLUTIONS OF SEMILINEAR EVOLUTION EQUATIONS SATISFYING AN ENERGY INEQUALITY

Hansjoerg Kielhoefer Aug. 1978 49 p refs
(Contract DAAG29-75-C-0024)
(AD-A063967; MRC-TSR-1869) Avail: NTIS HC A03/MF A01 CSCL 12/1

We prove the global existence (in time) for any solution of an abstract semilinear evolution equation in Hilbert space provided the solution satisfies an energy inequality and the nonlinearity does not exceed a certain growth rate. When applied to semilinear parabolic initial-boundary-value problems the result admits also the limiting growth rates which were given by Sobolevskii and Friedman, but which were not permitted in their theorem. The Navier-Stokes system in two dimensions is a special case of our general result. The method is based on the theories of semigroups and fractional powers of regularly accretive linear operators and on a nonlinear integral inequality which gives the crucial a-priori estimate for global existence. Author (GRA)

N79-22830# Wisconsin Univ. - Madison. Mathematics Research Center.

REMARKS ON THE SCHROEDINGER OPERATOR WITH SINGULAR COMPLEX POTENTIALS

Haiem Brezis (Paris Univ.) and Tosio Kato (Calif. Univ., Berkeley) Aug. 1978 22 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-04655)
(AD-A063978; MRC-TSR-1875) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let A = - delta be a Schroedinger operator on an open set omega is contained in R m squared, where V is a member of L superscript 1 subscript loc (omega) is a complex valued function. The maximal realization of A in L squared (omega) under Dirichlet boundary condition is considered. The operator A sub 1 = - delta + V is also analyzed. Schroedinger operators of the form A = - delta + V (x), where delta is the Laplacian and V is a scalar potential, arise in quantum mechanics and other areas. Delicate questions concerning what domain should be assigned to A must be settled in order to have a good theory. These questions are answered for a very general class of potentials V which may even have complex values. L.S.

N79-22831# Wisconsin Univ. - Madison. Mathematics Research Center.

A LOWER BOUND FOR THE PERMANENT OF A DOUBLY STOCHASTIC MATRIX

Shmuel Friedland (Hebrew Univ.) Sep. 1978 19 p refs
(Contract DAAG29-75-C-0024)
(AD-A063980; MRC-TSR-1882) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that the permanent of an n x n doubly stochastic matrix is not less than e to the -n power. Author (GRA)

N79-22832# Wisconsin Univ. - Madison. Mathematics Research Center.

ASYMPTOTIC BEHAVIOR OF SEMILINEAR REACTION-DIFFUSION SYSTEMS WITH DIRICHLET BOUNDARY CONDITIONS Technical Summary Report

Robert A. Gardner Nov. 1978 27 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A063997; MRC-TSR-1896) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper gives conditions which imply the existence of a unique, globally attracting steady state solution of a certain class of reaction-diffusion systems with inhomogeneous Dirichlet conditions. In addition, an example is given which shows that when the above conditions are not satisfied the steady state may bifurcate. Author (GRA)

N79-22833# Wisconsin Univ. - Madison. Mathematics Research Center.

NUMERICAL SOLUTION OF A SINGULARLY PERTURBED NONLINEAR VOLTERRA EQUATION

Olavi Nevanlinna Sep. 1978 28 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)
(AD-A064033; MRC-TSR-1881) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper we discuss the numerical solution of a problem which arises in polymer rheology: A mathematical model was derived to describe the elastic recovery of molten plastics. We replace this model by a discrete model, for which the solution can immediately be constructed by computer. The main part of this paper concerns the relation between the solutions to the original and discretized models. The original problem is a Volterra equation; Volterra equations usually occur when one models evolutions which depend on their history. We would like to emphasize that when one solves Volterra equations numerically, it is important that the discrete problem have similar qualitative properties to the original one. In the particular problem considered here, this forces us to choose a rather poorly convergent method if we wish to guarantee the results obtained. The numerical results confirm a discrepancy between theory and experiments indicated previously, namely that when the elongation of a filament is large and rapid, the model predicts somewhat more recovery than is observed experimentally. GRA

N79-22834# Maryland Univ., College Park. Computer Vision Lab.

A NOTE ON THE MEASUREMENTS OF QUANTIZED AREAS AND BOUNDARIES Interim Report

Dennis Rosen Nov. 1978 19 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A064819; TR-713; AFOSR-79-0051TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Pixels in quantized pictures are considered as cells in a grid, but a pixel may be represented by a lattice point placed at its center. It is argued that the perimeter of an area is its grid point boundary, not its lattice point boundary, the former always being 4 units greater than the latter, whatever the shape of the area. Use of the grid point boundary gives satisfactory values of perimeter, P, area, A, and compactness, P squared, with a minimum value of 16 for P squared. However, quantized drawn lines are most conveniently represented by the line joining lattice points, if an empirical procedure is adopted to remove ambiguities arising from the quantization. Author (GRA)

N79-22835# Army Research Office, Research Triangle Park, N. C.

TRANSACTIONS OF THE 24TH CONFERENCE OF ARMY MATHEMATICIANS Interim Technical Report

Jan. 1979 497 p refs Conf. held in Charlottesville, Va., 31 May - 2 Jun. 1978
(AD-A064433; ARO-7-1) Avail: NTIS HC A21/MF A01 CSCL 12/1

Partial Contents: Choosing a Mathematical Model for a System Affected by Noise; Some Bounds for Optimal Maneuvers and Predictors; Stochastic Models, Non-linear Models and Time-Variable Deterministic Models of Combat; A Solution for Non-cooperative Games; Improvement in the Computed Internal Energies for Conical Shaped Charges; Stress Intensity Factors for a Circular Ring with Uniform Array of Radial Cracks using Cubic Isoparametric Singular Elements; Temperatures and Stresses due to Quenching of Hollow Cylinders; Hyperparity in Nonlinear systems; Asymptotic Solutions to a Stability Problem; An Inverse Hyperbolic Boundary Value Problem; Some Analytical Aspects of a Nonlinear Transient Electromagnetic Field Penetration Problem; Steady in-plane Deformation of the Noncoaxial Plastic Soil; Large Plastic Deformation in a Radial Drawing Process; The Radiation Pattern of a Dielectric Antenna - an Asymptotic Approach; The Integral Equation of Image Reconstruction; Stability of Interpolating Elastica; On the Optimization of the Modified Maximum Entropy Spectrum of Linear Adaptive Filters; Time-Optimal Rejection Sequencing; Band Matrices with Toeplitz Inverses; Stochastic Theory of Rotor Blade Dynamics; Hyperbolic Conservation Laws; Analysis of a Stochastic Reynolds Equation and Related Problems; Application of Jensen's Inequality for Adaptive Suboptimal Design. GRA

N79-22836# Cincinnati Univ., Ohio. Dept. of Engineering Science.

A CRITICAL EVALUATION OF COMPUTER SUBROUTINES FOR SOLVING STIFF DIFFERENTIAL EQUATIONS Technical Report, 1 Sep. 1977 - 15 Oct. 1978

Dennis C. Krinke and Ronald L. Huston 15 Oct. 1978 103 p refs
(Contract N00014-76-C-0139)
(AD-A064545; UC-ES-101578-8-ONR) Avail: NTIS HC A06/MF A01 CSCL 12/1

A number of commonly available computer subroutines for

solving differential equation systems are tested and compared for their ability to solve stiff systems. A stiff system is defined as either: a system with widely separated eigenvalues or time constants or a system with diverging exponential terms which have small or zero coefficients due to a particular choice of initial conditions. For example, it is believed that the governing differential equations of large complex mechanical system models (such as, human-body/crash-victim simulation models, finite segment structural models, and large vibrating system models) are frequently stiff. GRA

N79-22161*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FURTHER RESULTS ON FAST TRANSFORMS FOR DECODING REED-SOLOMON CODES OVER GF (2 TO THE N POWER) FOR N EQUALS 4,5,6,8
I. S. Reed (University of Southern California), T. K. Truong, R. L. Miller, and B. Benjauthrit *In its* The Deep Space Network 15 Apr. 1979 p 132-155 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-22837# Tennessee Univ., Knoxville. Dept. of Psychology.
ESTIMATION OF THE OPERATING CHARACTERISTICS OF ITEM RESPONSE CATEGORIES. 5: WEIGHTED SUM PROCEDURE IN THE CONDITIONAL P.D.F. APPROACH
Fumiko Samejima 10 Dec. 1978 126 p refs
(Contract N00014-77-C-0360; NR Proj. 150-402; RR0420401)
(AD-A063917; RR-78-4) Avail: NTIS HC A07/MF A01 CSCL 12/1

Conditional P.D.F. Approach for estimating the operating characteristics of item response categories has been introduced earlier. In this study, a variation of this approach is introduced, which is called Weighted Sum Procedure, in contrast to the previous one, which is now called Simple Sum Procedure. The new method is applied to the same hypothetical data, i.e., the maximum likelihood estimates of ability of the five hundred hypothetical subjects and their responses to the ten binary items each of which follows the normal ogive model. The criterion item characteristic function for each binary item is obtained and compared with the one obtained in the simple sum procedure to find out if the new procedure has possibilities for a better estimation than the previous one. This is actually done using 'pseudo' criterion item characteristic functions which adopt the approximated density functions of the maximum likelihood estimate by polynomials of degree 3, 4 and 5 by means of the method of moments. Also the Pearson System Method and the Two-Parameter Beta Method are used for both Degree 3 and 4 Cases in this variation of the Conditional P.D.F. Approach and the results are compared. GRA

N79-22838# Air Force Geophysics Lab., Hanscom AFB, Mass.
CONDITIONAL JOINT PROBABILITIES
Irving I. Gringorten 2 Oct. 1978 26 p refs
(AD-A063817; AFGL-TR-78-0238; AFGL-ERP-643) Avail: NTIS HC A03/MF A01 CSCL 12/1

Formerly, for the solution of the conditional probability of a single predictand, its equivalent normal deviate (END) was obtained, under the assumption of multivariate normality, by linear regression on the END's of the predictors. For the joint probability of two predictands, the approach is to find the two corresponding END's by the same method, but in addition, to find the conditional correlation coefficient between the predictands. Such correlation has proved to be the well-known partial correlation. In a few test examples, the conditional correlation has decreased significantly from the more basic unconditional correlation. However, the conditional correlation has remained large enough to make the conditional probabilities significantly higher than the mere product of the two marginal probabilities.
Author (GRA)

N79-22839# Iowa State Univ. of Science and Technology, Ames. Statistical Lab.
ORDER STATISTICS AND NONPARAMETRIC STATISTICS Final Report, 1 Oct. 1972 - 30 Sep. 1978
Herbert A. David Dec. 1978 10 p refs
(Grant DA-ARO(D)-31-124-73-G55; DAAG29-76-G-0057)
(AD-A063906; ARO-11259.18-M; ARO-13198.19-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research reported falls under the headings: (a) order statistics; (b) competing risks; (c) nonparametric statistics, and (d) cyclic designs. (a) Concomitants of order statistics were introduced and studied as a class, and applications in selection and double sampling provided. The robustness of various estimators of location and scale in the presence of outliers was examined and the necessary tables prepared. Characterizations of distributions by properties of order statistics were given. A text on order statistics is being revised. (b) A parametric approach to the theory of competing risks was developed and a monograph of competing risks prepared. Applications to reliability under multiple causes of failure are included. (c) A number of problems were resolved in nonparametric estimation and in the asymptotic theory of linear rank statistics, U-statistics, and quantiles. (d) Following earlier work by the author a monograph on cyclic designs was co-authored. This is in a form ready for use, with worked examples provided. Author (GRA)

N79-22840# Tennessee Univ., Knoxville. Dept. of Psychology.
ESTIMATION OF THE OPERATING CHARACTERISTICS OF ITEM RESPONSE CATEGORIES. 6: PROPORTIONED SUM PROCEDURE IN THE CONDITIONAL PDF APPROACH
Fumiko Samejima Dec. 1978 123 p refs
(Contract N00014-77-C-0360; RR0420401)
(AD-A063918; RR-78-5) Avail: NTIS HC A06/MF A01 CSCL 12/1

Following Simple Sum Procedure and Weighted Sum Procedure, another method, Proportioned Sum Procedure, is introduced in the context of the Conditional P.D.F. Approach. The new method is somewhat different from the previous two, however, in the sense that the set of conditional density functions is not exclusively recategorized into the item score groups, but they are proportioned into each item score category. The same hypothetical data, i.e., the maximum likelihood estimates of the five hundred hypothetical subjects and their responses to the ten binary items, each of which follows the normal ogive model, are used to try the method. The criterion item characteristic function for each binary item is obtained and compared with those obtained by the other two procedures. The Pearson System Method and the Two-Parameter Beta Method are used for both Degree 3 and 4 Cases, and the results are compared with the previous ones. The mean square errors are adopted in evaluating both the resultant estimated item characteristic functions and probability density functions of ability. The two item parameters in the normal ogive model are also estimated for each item, and the results are compared with the previous ones.
Author (GRA)

N79-22841# Wisconsin Univ. - Madison. Mathematics Research Center.
THE RELATION BETWEEN STATISTICAL DECISION THEORY AND APPROXIMATION THEORY
Bernard Harris and Gerhard Heindl (Technische Univ., Munich) Oct. 1978 14 p refs
(Contract DAAG29-75-C-0024)
(AD-A063983; MRC-TSR-1890) Avail: NTIS HC A02/MF A01 CSCL 12/1

The approximation theory model describes a class of optimality principles in statistical decision theory as follows. Let S be the risk set of a statistical decision problem, that is, S = (R sub phi theta), theta an element of Theta, phi an element of Phi where Phi is the collection of randomized decision procedures, Theta is the parameter space and R sub phi(theta) is the risk function of the statistical decision procedure phi. We interpret S as a set in the normed linear space L. Let v=v(theta) satisfy v(theta) < or = R sub (phi) for all phi an element of Phi and all theta an element of Theta. Then s sub 0 an element of S is said to be (v,L) optimal if abs. val. (s sub 0-v) < or = abs. val. (s-v) for all s an element of S. It is easily seen that many

well-known optimality principles of statistics are of this type, such as Bayes rules and minimax rules. In this paper, characterization theorems for this class of optimality principles are given. GRA

N79-22842# Wisconsin Univ. - Madison. Mathematics Research Center.
TESTING HYPOTHESES FOR EFFECTS ON SURVIVAL BY THE ANALYSIS OF A MATCHED RETROSPECTIVE DESIGN
Bernard Harris and Anastasios A. Tsiatis Nov. 1978 15 p refs
(Contract DAAG29-75-C-0024; Grant PHS-CA-18332)
(AD-A063999; MRC-TSR-1899) Avail: NTIS HC A02/MF A01 CSCL 12/1

In testing for the relation of risk factors to a particular cause of death, such as a rare disease, a longitudinal study requires the observation of many individuals for long periods of time before enough information is accrued to permit reliable statistical analysis. In the present paper, this difficulty is circumvented through the use of a matched retrospective design. In particular, tests of the hypothesis of no effect are obtained for the constant proportionality model and for a second model in which the risk factors are quantified. The asymptotic distribution of the test statistics are also derived. Author (GRA)

N79-22843# Florida State Univ., Tallahassee.
CHARACTERIZATION OF PARTIALLY ORDERED CLASSES OF LIFE DISTRIBUTIONS Interim Report
Naftali A. Langberg, Ramon V. Leon, and Frank Proschan Oct. 1978 23 p refs
(Grant AF-AFOSR-0093-79; AF Proj. 2304)
(AD-A064821; FSU-Statistics-M481; TR-78-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper characterizations are obtained of life distributions F such that 1/G(F) is convex (concave) and alternatively 1/G(F) is starshaped (antishaped), where G is an absolutely continuous life distribution with positive, bounded, right continuous density. These characterizations generalize earlier results for the IFR(DFR) and IFRA(DFRA) classes, and should prove useful in unifying the study of the class distributions with decreasing density, comparing Weibull (Gamma) distributions with different shape parameters, etc. Author (GRA)

N79-22844# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
NONSTOCHASTIC TECHNIQUES FOR SELECTING RIDGE PARAMETER VALUES Interim Report
Richard F. Gunst and Tsushung A. Hua Jan. 1978 25 p refs
(Grant AF-AFOSR-2871-75)
(AD-A064838; AFOSR-79-0057TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Biased regression estimators are increasingly being utilized as alternatives to least square parameter estimators in multiple linear regression when the predictor variables are multicollinear. One popular biased estimator is the ridge regression estimator. Ridge estimators are known to have smaller mean squared errors than least squares for suitably small nonstochastic choices of the ridge parameter. To date, however, most of the practical applications of ridge regression employ stochastic techniques to select the ridge parameter. In this paper three non-stochastic procedures for choosing ridge parameters are compared and examined as is their performance with another stochastic method. Author (GRA)

N79-22845# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CRITERION FOR SELECTION OF VARIABLES IN A REGRESSION ANALYSIS M.S. Thesis
Larry J. Pulcher Dec. 1978 137 p refs
(AD-A064658; AFIT/GOR/MA/78D-5) Avail: NTIS HC A07/MF A01 CSCL 12/1

The Test of Equality between Subsets of Coefficients in Two Regressions is developed and applied as a means to pre-screen variables from a regression model. Some criterion for selection of variables are discussed and some existing regression packages are applied to data on characteristics of avionics equipment for comparison purposes. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N79-22846 Ohio State Univ., Columbus.
THE ANALYSIS OF DYNAMICALLY INTERACTIVE SYSTEMS Ph.D. Thesis
William Randolph Simpson 1978 163 p
Avail: Univ. Microfilms Order No. 7908216

Dynamically interactive systems are characterized by a mutual interaction in which each of the systems responds to each of the other systems according to its perception of the problem and its perceived methods of achieving a goal or objective. The analysis of dynamically interactive systems is approached from a non-deterministic viewpoint. Measures of effectiveness were developed which adequately reflect the form and substance of the interaction. Numerical procedures are presented for a given example of the problem class, together with comparisons to previously derived analysis variables and previously defined measures-of-effectiveness. Examples of conclusions and recommendations together with sensitivity analyses are described. Certain of these measures were verified. Dissert. Abstr.

N79-22847# Naval Academy, Annapolis, Md. Div. of Engineering and Weapons.
SYNTHESIS OF OPTIMAL LADDER NETWORKS Progress Report, Jun. 1973 - May 1977
Tian S. Lim Nov. 1978 144 p refs
(AD-A064291; USNA-EW-16-78) Avail: NTIS HC A07/MF A01 CSCL 12/2

This project treats synthesis procedures for optimal ladder networks. The first part of the project deals with a chain-matrix decomposition technique for realizing two-port LC ladder networks. Two chain-matrix decomposition theorems are proved. These theorems state the necessary and sufficient conditions that must be satisfied by a (2x2) matrix S sub n(s) that is to be decomposed into a product of simple matrices, i.e., S sub n(s) = K sub 1 K sub 2...K sub n. It is found that the zeroes of the adjacent elements of S sub n(s) alternate pairwise along the j(omega) axis in the s-plane. It is also found that if the matrix S sub n(s) is the overall chain matrix of an LC ladder network, then each of the simple matrices K sub i(s) for i = 1,2,...n represents a simple LC ladder section. These decomposition techniques are then applied to the design of filters. Of particular interest are Butterworth, Chebyshev, and Bessel filters with single and double terminations. These filters are designed by the decomposition of chain matrices whose elements are predetermined by the orthogonal polynomials that approximate the ideal filter characteristics. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-22848# Michigan Univ., Ann Arbor. Computer Information and Control Engineering.
EQUIVALENCES BETWEEN MARKOV RENEWAL PROCESSES
Burton Simon Jul. 1978 42 p refs
(Contract N00014-77-C-0743; Grants AF-AFOSR-2903-76; NSF ENG-75-20223; AF Proj. 2304)
(AD-A064544; CICE-78-1; AFOSR-79-0026TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A form of equivalence between Markov-renewal processes that includes strong and weak lumpability as special cases was defined, and its properties were examined. If (X sub n, T sub n) is a Markov-renewal process with kernel Q(t) and (Z sub n, S sub n) is a Markov-renewal process with kernel Y(t), then it is shown that (X sub n, T sub n) and (Z sub n, S sub n) are equivalent if and only if there is a certain homomorphism between the matrix rings generated by Q(t), t an element from zero thru infinity and Y(t), t an element from zero thru infinity. The equivalence is identical to weak lumpability in the case where (Z sub n, S sub n) is a renewal process. Although the conditions

for strong lumpability can be written in an attractive form, they are too restrictive to be of any real interest. Weak lumpability is of more interest since (as will be shown) it occurs in less trivial examples, but the necessary conditions are very complicated. The equivalence defined herein has the advantage of having simple necessary and sufficient conditions. Author (GRA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-22849*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A CORRELATION OF MIXING NOISE FROM COANNULAR JETS WITH INVERTED FLOW PROFILES

S. Paul Pao Apr. 1979 127 p refs

(NASA-TP-1301; L-12155) Avail: NTIS HC A07/MF A01 CSCL 20A

Data are correlated for jet mixing noise from coannular jets with inverted flow velocity profiles. The acoustic performance of coannular jets is compared to the performance of a hypothetical single jet with the same total mass flow, thrust, and total enthalpy flow as the coannular jet. The study shows that coannular jets with velocity ratios greater than 1.2 produce less noise than their corresponding equivalent tests and that optimum noise reduction of coannular jets in the data set occurs within a range of equivalent velocities between 500 and 700 meters per second and velocity ratios between 1.6 and 2.3. The maximum sound power reduction is found to be about 4 decibels. Directivity indices and a special set of spectral curves were developed to describe the characteristic double peak spectra of coannular jet noise. The temperature ratio between the inner and outer streams was not found to be important in this acoustic correlation. However, the mean temperature effect was included in the computations of sound pressure levels. L.S.

N79-22850*# Advanced Analytical Research, Inc., Westport, Conn.

NONLINEAR EFFECTS ON SOUND PROPAGATION THROUGH HIGH SUBSONIC MACH NUMBER FLOWS IN VARIABLE AREA DUCTS Final Report

Andrew J. Callegari May 1979 86 p refs

(Contract NAS1-14926)

(NASA-CR-3138) Avail: NTIS HC A05/MF A01 CSCL 20A

A nonlinear theory for sound propagation in variable area ducts carrying a nearly sonic flow is presented. Linear acoustic theory is shown to be singular and the detailed nature of the singularity is used to develop the correct nonlinear theory. The theory is based on a quasi-one dimensional model. It is derived by the method of matched asymptotic expansions. In a nearly chocked flow, the theory indicates the following processes to be acting: a transonic trapping of upstream propagating sound causing an intensification of this sound in the throat region of the duct; generation of superharmonics and an acoustic streaming effect; development of shocks in the acoustic quantities near the throat. Several specific problems are solved analytically and numerical parameter studies are carried out. Results indicate that appreciable acoustic power is shifted to higher harmonics as shocked conditions are approached. The effect of the throat Mach number on the attenuation of upstream propagating sound excited by a fixed source is also determined. Author

N79-22851# Federal Aviation Administration, Washington, D. C. Office of Environmental Quality.

INTEGRATED NOISE MODEL

Apr. 1978 16 p Original contains color illustrations

Avail: NTIS HC A02/MF A01

A valuable noise-simulation computer-based tool for describing and defining the impact of aircraft noise around an airport is described. The integrated noise model (INM), which is useful in assessing actual or predicted airport noise impacts, takes into account all pertinent impact parameters including types and numbers of aircraft operating at the airport, flight tracks, operating procedures, and time of day of aircraft operations. The capabilities and characteristics of the INM are discussed in order to provide a better understanding of aircraft noise, the need for the INM, and its potential applications. A.R.H.

N79-22852# Stanford Univ., Calif.

ACOUSTIC MICROSCOPIC STUDY OF MATERIALS Final Report, 30 Sep. 1977 - 30 Sep. 1978

C. F. Quate Nov. 1978 15 p

(Grant AF-AFOSR-3455-77)

(AD-A064562; GL-2890; AFOSR-79-0008TR) Avail: NTIS HC A02/MF A01 CSCL 17/1

This research program is based upon the study of the properties of electronic microstructures with acoustic microscopy. It has a further objective of improving the author's understanding of this emerging technology as a new form of imaging the detail in modern microcircuits. The scope of this area is ever increasing and new methods for analyzing features on this scale are important. The theory of the acoustic microscope and the resolving power of this instrument have both been advanced during the initial period of the program. The resolving power of the best instrument is now comparable to the optical microscope. A new form of the microscope which is described by the term 'photoacoustic microscope' and holds the potential for revealing still more information on the detailed structure of microcircuits was demonstrated. GRA

N79-22853# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.

EFFECTS OF TIDALLY-VARYING SOUND SPEED ON ACOUSTIC PROPAGATION OVER A SLOPING OCEAN BOTTOM

W. L. Siegmann, M. J. Jacobson, and K. G. Hamilton 1 Feb. 1979 56 p refs

(Contract N00014-76-C-0288)

(AD-A064660; RPI-MATH-123) Avail: NTIS HC A04/MF A01 CSCL 20/1

The influence of sound-speed fluctuations on propagation of a CW signal in an ocean with a uniformly-sloping bottom and a horizontal surface is analyzed using ray theory. The mean sound-speed structure is modeled as bilinear, with bottomed source and receiver above and below the SOFAR axis, respectively. The horizontally-independent fluctuations oscillate with a 12-h period in the upper ocean. An examination is made of possible types of rays for down-slop propagation that might exist, depending on bottom-slope angle and source-receiver separation. The total acoustic field is investigated for its dependence on these parameters and time. For certain conditions when up to three rays comprise the mean total field, three patterns of time evolution are described, each of which may have significant amplitude variations. Numerically-computed examples of each type are presented. The linear relationships between phase variations of individual rays and the sound-speed fluctuations are derived. Then, formulas are developed to explain the most frequent behavior of the relative amplitude and phase of the multipath total field. Predictions from the formulas show very good agreement with the numerical calculations. Author (GRA)

N79-22854# Lockheed-Georgia Co., Marietta.

THE GENERATION, RADIATION AND PREDICTION OF SUPERSONIC JET NOISE. VOLUME 2, APPENDIX: COMPUTER PROGRAM LISTING Final Technical Report, 1 Dec. 1975 - 1 Sep. 1978

B. J. Tester, P. J. Morris, H. K. Tanna, and D. F. Blakney Oct. 1978 134 p refs

(Contract F33615-76-C-2021)

(AD-A064685; LG78ER0262-Vol-2; AFAPL-TR-78-85-Vol-2)

Avail: NTIS HC A07/MF A01 CSCL 20/1

This appendix volume presents a complete listing of the unified jet noise prediction computer program (UNIJET), developed to predict the total noise from a subsonic or supersonic jet under static conditions. In addition, a listing of the computer program (called INTEG) to predict absolute turbulent mixing noise levels at 90 deg to the jet axis, using laser velocimeter turbulence measurement, is also given. A detailed description of these two programs in the form of a user's guide is given in the main volume of this report. Author (GRA)

N79-22855# Armament Development and Test Center, Eglin AFB, Fla.

FOCUS: A COMPUTERIZED AID FOR MAKING SOUND PROPAGATION FORECASTS Final Report

J. P. Kahler Jan. 1979 83 p refs

(AD-A065168; ADTC-TR-79-8) Avail: NTIS HC A05/MF A01 CSCL 20/1

A computerized aid for use in making predictions of far-field sound propagation in the atmosphere is described. The computer program, which was written for a PDP 11/45 minicomputer, traces acoustic rays through a moving, stratified, vertically-inhomogeneous atmosphere to provide the information needed to predict the locations and intensities of focused and lesser amplified propagated sound generated by high explosive detonations and other sources. It also provides locations of quiet zones. Output from the computer program consists of velocity-of-sound profiles, ray destination histograms, focus factors, peak-to-peak pressure amplitudes, and ray destinations. The output can be produced in the form of CRT plots, Calcomp plots, and computer printouts. There are many optional outputs and several options on input data that can be selected by the user. The program assumes a point sound source that is surface based and does not consider terrain or earth curvature. Although these assumptions limit the horizontal range and situations under which it can be considered valid, the program should still be useful as an aid in producing forecasts for most surface-based sound sources other than those of unusually high TNT equivalent yields. Author (GRA)

N79-22856# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.

FATIGUE-RESISTANT LEAD SHEET AND LEAD LAMINATE NOISE BARRIERS

M. M. Tilman and J. W. Jensen 1978 25 p refs

(PB-289770/0; BM-RI-8383) Avail: NTIS HC A02/MF A01 CSCL 11F

The Bureau of Mines conducted research to determine whether it is possible to substantially improve the fatigue resistance of lead sheet by means of surface coatings. Five types of coatings were applied to unalloyed chemical lead sheet. Flexural tests revealed that the best fatigue resistance was obtained with coatings of vacuum grease. Coated lead sheet was also tested in short-term tensile tests and in tensile creep tests. Creep resistance was also improved in varying degrees by most of the coatings. Research was also conducted on the effectiveness of noise barriers by using sheet lead in combination with other materials. GRA

N79-22324# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

NOISE ASPECTS IN HEATING AND AIR CONDITIONING SYSTEMS

F. Henderieckx *In its* Internal Flow Aspects and Circuit Design of Heating and Ventilation Systems May 1974 91 p refs (For primary document see N79-22320 13-31)

Avail: NTIS HC A15/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-22857 Northwestern Univ., Evanston, Ill.

THEORETICAL AND SPECTROSCOPIC STUDIES OF THE CONFORMATIONS OF PERMETHYLPOLYSILANES AND RELATED MOLECULES, 1. SCF STUDIES AND COMPARISONS OF THE MOLECULAR STRUCTURES OF DIMETHYL ETHER AND DISILOXANE, 2 Ph.D. Thesis

Chariya Asawaroengchai Ernst 1978 201 p

Avail: Univ. Microfilms Order No. 7907871

The conformational properties of decamethyltetrasilane were studied by variable temperature NMR and vibrational (IR and Raman) spectroscopy. Variable temperature H-1 and C-13 nmr were also studied and at very low temperatures, broadening of the two proton resonances (SIME2, SIME3) is observed, although temperatures low enough to achieve decoalescence could not be attained. However, by approximate lineshape analysis of the spectra, the activation energy could be estimated as 2.21 kcal/mole. Comparisons of the thermodynamic and kinetic conformational parameters with those of related systems are also presented. Pseudopotential SCF calculations of the molecular structures of the simple compounds, (H3SI)2O and (H3C)2O were undertaken to study the extent and importance of d orbital participation. Dissert. Abstr.

N79-22858 Florida Univ., Gainesville.

THREE-BODY THEORY AND COMPUTATIONAL ASPECTS OF COLLISIONS BETWEEN ATOMS AND DIATOMIC MOLECULES Ph.D. Thesis

Zeki Cemal Kuruoglu 1978 243 p

Avail: Univ. Microfilms Order No. 7907764

The dynamics of three interacting atoms is considered within the Faddeev theory of three-particle dynamics. A formal procedure which leads to a decomposition of the total interaction in terms of the diatomic interactions and a small three-atom interaction is outlined. The formulation of the separable approximations to the diatomic transition operators is considered and the Faddeev-type equations for the multichannel transition operators are examined. An effective two-body formalism is developed by using the separable expansions of the two-particle transition operators. Variational calculations of the two-particle transition matrices are reported. Direct-matrix-inversion, Pade and variational methods are employed in model three-nucleon calculations. The convergence of the variational separable approximations to the diatomic transition operators within the context of the three-atom problem is considered. Dissert. Abstr.

N79-22859 State Univ. of New York at Buffalo.

PURE AND MIXED MONOMOLECULAR FILM INTERACTIONS OF MEMBRANE SPIN PROBE MOLECULES Ph.D. Thesis

Friedel Mueller-Landau 1978 214 p

Avail: Univ. Microfilms Order No. 7905672

Electron spin probe molecules were studied as model systems to investigate how a label and its substitution position influence the properties of an unsubstituted surfactant in both pure and mixed films. The condensing effect of 3-DC on a straight chain hydrocarbon film is similar to that of cholesterol. A model is presented which explains this condensing effect in terms of the proximity interaction of neighboring film molecules. An extension of the model relates the observed surface area of steroids (cholesterol, cholestanol, epicholesterol, cholestone, 3-DC) to a specific tilt angle of the molecule towards the interface. The influence of the probe molecules on the liquid expanded/liquid condensed phase change of the host film is found to be determined not so much by the area reducing accommodation but by the degree to which the probe is able to hydrophobically interact in a host film. Dissert. Abstr.

N79-22860 Tufts Univ., Medford, Mass.

BREAKING EXCHANGE DEGENERACY AND MULTIQUARK STATES Ph.D. Thesis

Padmanabhan Haridas 1978 165 p

Avail: Univ. Microfilms Order No. 7907209

The connection between exchange degeneracy breaking and multiquark states within the framework of a highly constrained dual approach was studied. It is shown that M sub 4 states (baryonium) emerge at the daughter trajectory level as a consequence of the vector-tensor (meson) exchange degeneracy breaking in the meson-meson system. These states are shown to be weakly coupled to the external pseudoscalar mesons and have narrow widths as expected from duality. They are good

candidates for many narrow width states that were observed in recent experiments. The analysis is extended to meson-baryon and baryon-antibaryon systems and it is shown how other multiquark states like B sub 5 and possibly even dibaryons could be accommodated at the daughter trajectory levels in the appropriate channels. Dissert. Abstr.

N79-22861 Illinois Univ. at Chicago Circle, Chicago.
ELECTRONIC SPECTRA OF DIATOMIC MOLECULES AND THEIR ASTROPHYSICAL APPLICATIONS Ph.D. Thesis
Roger Stephen Kolman 1978 168 p
Avail: Univ. Microfilms Order No. 7908410

Theoretical and experimental spectroscopic studies were made of several electronic transitions of two molecules of astrophysical interest AlO and BaO. The spectrum of AlO is observed in sunspots and in the study of normal M-type stars and long period variable stars. Due to the large number of metallic oxides present in the atmospheres of cool stars, BaO is expected to be found in these atmospheres. Dissert. Abstr.

N79-22862 Notre Dame Univ., Ind.
QUANTUM CHEMICAL STUDIES USING A GAUSSIAN-BASED MODEL POTENTIAL TO DESCRIBE SECOND AND THIRD ROW ATOMS AND DIATOMICS, THE INTERACTION OF AN ALUMINUM ATOM WITH ETHYLENE AND ACETYLENE, AND THE CHEMISORPTION OF ATOMIC HYDROGEN AND OXYGEN ON ALUMINUM CLUSTERS Ph.D. Thesis
Harry Francis Baney 1979 615 p
Avail: Univ. Microfilms Order No. 7908375

A Gaussian-based model potential is applied to second and third row atoms, using 3s + 3p and 5s + 5p basis sets to obtain total valence electron energies and valence electron molecular orbital energies. The two bases are contracted into double zeta-like (2,1)s + (2,1)p and (4,1)p sets and are used to study third row hydrides, Al2, and AlO. Molecular orbital descriptions of the organometallics AlC2H4 and AlC2H2 are presented using the HFR-SCF-LCAO-MO method and the Gaussian-based model potential method. The molecular orbital descriptions are compared to experimental results obtained by metal atom matrix techniques. The chemisorption of atomic hydrogen and oxygen on the overlead and hole sites of the (100) surface of aluminum metal is examined using the HFR-SCF-LCAO-MO method and the Gaussian-based model potential method. The overhead site is represented by 1, 5, and 9 aluminum atom clusters. Dissert. Abstr.

N79-22863 Oregon Univ., Eugene.
SPECTRUM OF HYDROGEN ATOM HAVING A HARMONICALLY BOUND NUCLEUS: BEYOND THE BORN-OPPENHEIMER APPROXIMATION Ph.D. Thesis
Richard James Bettega 1978 157 p
Avail: Univ. Microfilms Order No. 7907443

Spectral features of a quantum mechanical model system are determined within the formalisms of degenerate and nondegenerate perturbation theory. These features include energy level shifts, vibronic intensities, and interactions between members of degenerate manifolds not predicted by the application of the Born-Oppenheimer approximation to the model system. Time-dependent processes resulting in vibrationally induced pre-ionization are also investigated. The model system consists of a proton subject to a Hooke's law potential (constrained to quantum mechanical motion in one dimension) and an electron attracted to the proton by a Coulombic potential. The equilibrium position of the proton is the origin of an imposed coordinate frame. Such a system may be compared with a diatomic molecule such as rubidium hydride. The energy of the ground state of the model system as calculated by perturbation theory deviates from the Born-Oppenheimer approximation prediction by 2.6% of the zero-point energy of the proton. Dissert. Abstr.

N79-22864 Pennsylvania Univ., Philadelphia.
THE DETERMINATION OF SINGLE ATOM SURFACE SITE GEOMETRIES ON W(111), W(211), AND W(321) Ph.D. Thesis
Peter George Flahive 1978 133 p
Avail: Univ. Microfilms Order No. 7908733

The field ion microscope was used to identify the geometric configuration of single tungsten (211) and (321) surfaces and both nickel and tungsten atoms on the tungsten (111) surface immediately after adsorption from the vapor phase and subsequent to thermally induced motion on the surface. The experimental procedures coincidentally provide the information necessary to calculate adatom surface diffusion parameters. Dissert. Abstr.

N79-22865# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF PHASE-SPACE FINITE ELEMENTS TO THE NEUTRON TRANSPORT EQUATION IN CYLINDRICAL GEOMETRY M.S. Thesis
Ronald C. Wheaton Dec. 1978 70 p refs
(AD-A064209; AFIT/GNE/PH/78D-25) Avail: NTIS HC A04/MF A01 CSCL 18/11

Phase-Space finite elements are applied to the static monoenergetic neutron transport equation in two-dimensional cylindrical geometry by computer subroutines which collectively assemble the global phase-space matrix for solution. The technique uses a variational formulation based on the second-order self-adjoint form of the transport equation within which the dependent variable approximated by the finite elements is the even-parity component of the angular flux. Author (GRA)

N79-22866# California Univ., San Diego, La Jolla. Dept. of Physics.
QUASIPARTICLE DAMPING OF A POSITRON IN AN ELECTRON GAS
Joe Oliva Nov. 1978 44 p refs
(Contract N00014-76-C-0050; NR Proj. 017-653)
(AD-A063809; TR-48) Avail: NTIS HC A03/MF A01 CSCL 20/8

We present a calculation of the imaginary part of the self energy Sigma sub 1 of a positron in an electron gas. Sigma sub 1 is inversely proportional to the inelastic collision rate between the positron and the electron gas. The calculation was done using standard many body techniques and within the RPA approximation. There are two contributions to Sigma sub 1: one arising from particle-hole pair excitation, the other from plasmon excitation. GRA

N79-22867# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELECTRON-ELECTRON COLLISIONS: A SIMPLE MODEL FOR PARTIALLY IONIZED GASES M.S. Thesis
Harold L. Hastings Dec. 1978 102 p refs
(AD-A064212; AFIT/GEP/PH/78D-6) Avail: NTIS HC A06/MF A01 CSCL 20/8

The electron-electron collision term of the steady-state Boltzmann equation is replaced by a simple relaxation term that effectively linearizes the equation. Additional assumptions are made to simplify the equation further. Ionization is ignored and a two-level atom is assumed. The effects of a DC electric field are included. Using the relaxation term to account for electron-electron collisions, an approximate analytic solution is derived. Temporal and steady-state characteristics of the relaxation term are compared to those of the standard Fokker-Planck term. The relaxation term is judged invalid for energies greater than the excitation threshold. Author (GRA)

N79-22868# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PROJECTILE ENERGY DEPENDENCE OF ALUMINUM AND SILICON Ka X-RAY SATELLITES M.S. Thesis - Texas A and M Univ.
Blake Isamu Sonobe Aug. 1978 88 p refs
(AD-A064077; AFIT-CI-79-90T) Avail: NTIS HC A05/MF A01 CSCL 20/8

The K alpha satellite spectra of aluminum and silicon produced by collisions with 5.4 to 40.6 MeV helium ions, 12.0 to 74.1 MeV carbon ions, and 23.4 to 117.0 MeV neon ions have been measured. The apparent average L-vacancy fractions (P sub L) determined from the relative intensities of the satellite peaks were observed to be dependent on the projectile energy and atomic number and on the target atomic number. Comparisons of the binary-encounter approximation (BEA) and semiclassical approximation (SCA) predictions with the experimental PL values as a function of the projectile-to-L-shell electron velocity ratio for helium on aluminum are presented. It was found that the

BEA greatly over-predicted the degree of L-shell ionization and failed to accurately predict the shape of the velocity dependence. The SCA predicted the shape of the dependence at the higher velocities but was too low in magnitude. Author (GRA)

N79-22869# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

X-RAY BUILD-UP FACTORS M.S. Thesis

Gary M. Kalansky Dec. 1978 190 p refs
(AD-A064057; AFIT/GNE/PH/78D-18) Avail: NTIS HC A09/MF A01 CSCL 20/8

This report is a compilation of time integrated X-ray energy build-up factors from a monoenergetic point source in infinite homogeneous air. These factors were computed by the use of PHOTDIS, a moments method computer code, and performed on a CDC 6600. This code was chosen after a literature search and a review of many computer models. Energies from 12 keV to 1000 keV and ranges from 1 mean-free-path are considered. All results are presented on semi-log graphs with each graph containing one energy. This program is estimated to have an error of at most 20 percent. The results are compared to Monte Carlo and Discrete Ordinates calculations. Even though the moments calculations do not completely agree with any of the Monte Carlo calculations, the moments calculation agree with the average of the Monte Carlo calculations. A complete derivation of the moments method from the Boltzmann Transport Equation is also included. Author (GRA)

N79-22870# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

COMPUTER CODE TO ANALYZE ALPHA SPECTRA USING A SPECTRAL STRIPPING APPROACH M.S. Thesis

John R. Harstine Dec. 1978 143 p refs
(AD-A064056; AFIT/GNE/PH/78D-16) Avail: NTIS HC A07/MF A01 CSCL 07/2

Sources of Po(210) of varying thicknesses were prepared by an evaporative precipitation method. Sources of Am(241) and Pu(240) were analyzed with the spectra of these sources as reference peak functions using a modificaton of an existing computer code. The results showed a reduction of the residual from using a reference peak with a full width at half maximum close to that of the analyzed source. The performance of the computer code was also studied using randomized Gaussian peaks. Author (GRA)

N79-22871# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

COLLISION INDUCED DISSOCIATION OF DIATOMIC MOLECULES Final Report, Jan. 1976 - Jun. 1978

William F. Bailey Nov. 1978 278 p refs
(AF Proj. 2301)
(AD-A063876; AFAPL-TR-78-105) Avail: NTIS HC A13/MF A01 CSCL 07/4

A discrete collisional theory of dissociation under equilibrium and nonequilibrium conditions using a quantum kinetic approach to molecular energy transfer was investigated. The kinetic equations for molecular dissociation in a pure diatomic gas and diatomic gases in the presence of an inert diluent were formulated and solved. The incubation time was calculated and exhibited good agreement with experimental measurements. An analytic steady state form for the vibrational population and dissociation rate was developed which agreed with the time-dependent calculations. It was determined that rotational states play a significant role in the dissociation process and that the standard ladder model is inadequate. When rotational effects are properly included in the analysis, good agreement with experimental data is obtained. The kinetics developed to address thermal dissociation under equilibrium conditions were extended to treat the highly nonequilibrium conditions achieved through intense optical pumping or electron impact excitation. The nonequilibrium treatment included a detailed investigation of electron impact dissociation. A parametric study of heavy particle and electron impact dissociation rates revealed that under conditions typically encountered in electric discharges, electron impact dissociation dominates the heavy particle rate. Author (GRA)

N79-22872# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE EFFECTS OF BEAM CURRENTS ON ELECTRON ENERGY DISTRIBUTIONS M.S. Thesis

Edwin D. Sewar Dec. 1978 109 p refs
(AD-A064680; AFIT/GEP/PH/78D-12) Avail: NTIS HC A06/MF A01 CSCL 20/8

An attempt is made at determining the effects of an external flux of high energy electrons on the electron energy distribution function. An analytical model is developed for a simple system and compared against numerical results. Normalization problems precluded detailed investigation of the analytic solution. Numerical solutions were obtained for a more complex system using a Boltzmann computer code developed for this and three related theses. It was found that an electron beam tends to mask the effects of an applied dc field in the high energy region of the electron distribution function. This accounts for an uncharacteristic dip in efficiency curves for processes with high threshold energies as the magnitude of the applied field increases. The beam also accounts for an insensitivity of pumping rate constants to variations in applied field strength for processes with high threshold energies. Author (GRA)

N79-22873# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

SPACE CHARGE LIMITING CURRENTS IN A DRIFT TUBE OF FINITE LENGTH M.S. Thesis

Steve Harrington Sep. 1978 71 p refs
(AD-A064416; AFIT/GEP/PH/78D-5) Avail: NTIS HC A04/MF A01 CSCL 20/7

The equation governing the steady state potential distribution created by a cold unneutralized annular relativistic electron beam propagating axially within a finite length drift tube with grounded anode foil, collector plate, and walls and immersed in an axially directed infinite magnetic guide field is solved numerically using the method of finite elements. These numerical results are used to check the accuracy of available analytical approximations to the limiting current. GRA

N79-22874# Wright State Univ., Dayton, Ohio. Brehm Lab.

OPTICAL EMISSION FROM ION-ATOM AND ION MOLECULE INTERACTIONS Final Report, 1 Jul. 1977 - 30 Jun. 1978

E. Grant Jones Dec. 1978 86 p refs
(Contract F33615-77-C-3141; AF Proj. 2301)
(AD-A064970; AFAPL-TR-78-99; Rept-3699-L2) Avail: NTIS HC A05/MF A01 CSCL 07/4

Reaction of the rare gases, Rg, (Rg = Ar, Kr, Xe) with helium molecular ions, argon molecular ions and argon ions producing excitation was investigated. All excitation is accompanied by the transfer of translational into internal energy via charge transfer or collisional excitation reactions. Collisions of the argon atomic and molecular ions are efficient in exciting the resonant radiation in the rg i spectrum. Kinetic energy thresholds for several of these reactions are reported. The symmetric system Xe ion/Xe was studied with respect to production of Xe ion neutral atomic resonance radiation. The effects of the electronic state of the reacting xenon ions are discussed and possible reaction mechanisms are proposed. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N79-22875*# United Technologies Research Center, East Hartford, Conn.

INITIAL CONCEPTUAL DESIGN STUDY OF SELF-CRITICAL NUCLEAR PUMPED LASER SYSTEMS

Richard J. Rodgers Apr. 1979 50 p refs
(Contract NAS1-14329)
(NASA-CR-3128) Avail: NTIS HC A03/MF A01 CSCL 20E

An analytical study of self-critical nuclear pumped laser system concepts was performed. Primary emphasis was placed on reactor concepts employing gaseous uranium hexafluoride (UF6) as the

fissionable material. Relationships were developed between the key reactor design parameters including reactor power level, critical mass, neutron flux level, reactor size, operating pressure, and UF6 optical properties. The results were used to select a reference conceptual laser system configuration. In the reference configuration, the 3.2 m cubed lasing volume is surrounded by a graphite internal moderator and a region of heavy water. Results of neutronics calculations yield a critical mass of 4.9 U(235) in the form (235)UF6. The configuration appears capable of operating in a continuous steady-state mode. The average gas temperature in the core is 600 K and the UF6 partial pressure within the lasing volume is 0.34 atm. Author

N79-22876*# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
GAS CORE REACTORS FOR ACTINIDE TRANSMUTATION Annual Report
J. D. Clement, J. H. Rust, Pak Tai Wan, and S. Chow 1 Apr. 1979 75 p refs
(Grant NsG-1288)
(NASA-CR-158498) Avail: NTIS HC A04/MF A01 CSCL 18K

The preliminary design of a uranium hexafluoride actinide transmutation reactor to convert long-lived actinide wastes to shorter-lived fission product wastes was analyzed. It is shown that externally moderated gas core reactors are ideal radiators. They provide an abundant supply of thermal neutrons and are insensitive to composition changes in the blanket. For the present reactor, an initial load of 6 metric tons of actinides is loaded. This is equivalent to the quantity produced by 300 LWR-years of operation. At the beginning, the core produces 2000 MWt while the blanket generates only 239 MWt. After four years of irradiation, the actinide mass is reduced to 3.9 metric tonnes. During this time, the blanket is becoming more fissile and its power rapidly approaches 1600 MWt. At the end of four years, continuous refueling of actinides is carried out and the actinide mass is held constant. Equilibrium is essentially achieved at the end of eight years. At equilibrium, the core is producing 1400 MWt and the blanket 1600 MWt. At this power level, the actinide destruction rate is equal to the production rate from 32 LWRs. A.R.H.

74 OPTICS

Includes light phenomena.

N79-22877 Iowa State Univ. of Science and Technology, Ames.
PIXEL DISPLACEMENT DETERMINATION IN CASCADED IMAGES UTILIZING COHERENT LIGHT FRINGE PATTERNS Ph.D. Thesis
Gary Alvin Granneman 1978 144 p
Avail: Univ. Microfilms Order No. 7907251

A type of optical image-image quasi-correlation technique to be used in the determination of pixel displacements occurring between multiple images of a scene is developed and demonstrated. This quasi-correlation technique shows itself to be quite capable for the determination of in-plane differential displacements. Pixel motion of any magnitude between one image and a second image is detectable to within a few micrometers in the image coordinate system. A special case of the two-dimensional theory, one-dimensional records, where the input records have information in one direction only and the separation distance is zero, is discussed and demonstrated. Dissert. Abstr.

N79-22878 Pennsylvania Univ., Philadelphia.
OPTICAL STUDIES OF PURE AND DOPED POLYACETYLENE Ph.D. Thesis
Curtis Robinson Fincher, Jr. 1978 203 p
Avail: Univ. Microfilms Order No. 7908732

Polyacetylene is the simplest of the linear polyenes which were the subject of a number of experimental and theoretical investigations. While pure polyacetylene is of a semiconducting nature, after doping with various halogen and alkali impurities the transport properties change drastically with the electrical conductivity changing by eleven orders of magnitude. A study of various optical properties of both pure and doped polyacetylene is presented. Dissert. Abstr.

N79-22879 Pennsylvania Univ., Philadelphia.
EXPERIMENTAL STUDIES IN RESONANT LIGHT SCATTERING AND ABSORPTION IN THE CONDENSED PHASE Ph.D. Thesis
Corinne Ann Nyi 1978 266 p
Avail: Univ. Microfilms Order No. 7908773

Resonance fluorescence and Raman spectra for excitation of single vibronic levels of the 7000 A 1B1 state of azulene in a naphthalene mixed crystal at 1.6 K are described. The intensity distributions for the resonance emission spectra were used to verify or reassign previously proposed correlations of the ground and excited state a1 modes. Relaxed fluorescence from levels populated via vibrational relaxation from the resonant vibronic level was observed and measurements of the steady state population ratios for the vibronic levels relative to the zero-point level are given. Dissert. Abstr.

N79-22880*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MULTISPECTRAL SCANNER OPTICAL SYSTEM Patent Application
Roy C. Stokes and N. Guy Koch, inventors (to NASA) (Lockheed Electronics Co., Inc.) Filed 29 Mar. 1979 21 p
(NASA-Case-MSC-18255-1; US-Patent-Appl-SN 025163) Avail: NTIS HC A02/MF A01 CSCL 20F

An optical system is described for use in a multispectral scanner of the type used in video imaging devices. Electromagnetic radiation reflected by a rotating scan mirror is focused by a concave primary telescope mirror and collimated by a second concave mirror. The collimated beam is split by a dichroic filter which transmits radiant energy in the infrared spectrum and reflects visible and near infrared energy. The long wavelength beam is filtered and focused on an infrared detector positioned in a cryogenic environment. The short wavelength beam is dispersed by a pair of prisms, then projected on an array of detectors also mounted in a cryogenic environment and oriented at an angle relative to the optical path of the dispersed short wavelength beam. NASA

N79-22881# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
TRACING OF LIGHT RAYS ALONG A PROJECTILE WAKE Final Report
R. Sedney, N. Gerber, and J. M. Bartos Nov. 1978 34 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A064099; AD-E430161; ARBRL-TR-02119) Avail: NTIS HC A03/MF A01 CSCL 17/8

The propagation of optical radiation longitudinally through the turbulent wake of a supersonic projectile is studied by means of geometrical optics. The differential equations for propagation of light rays in a non-homogeneous medium are integrated numerically for light traveling upstream from a pulsed point source located behind a moving projectile, and the shadow formed on a film located ahead of the projectile is calculated. The index of refraction is obtained from a semi-empirical model for the gas density in the wake. The calculated magnification of the projectile shadow diameter agrees with measured values to within 5%; such consistency between the calculations and experimental data is taken as justification of the model. This result suggests that geometrical optics is adequate for tracing rays along a wake and, therefore, for performing design calculations in the development of an optical miss distance sensor and design systems for beam rider projectiles and missiles. Author (GRA)

N79-22882# HTL Industries, Inc., Santa Ana, Calif. K West Div.
APPLICABILITY OF FIBER OPTICS TO AIRCRAFT FIRE DETECTION SYSTEMS Final Report, 15 May - 15 Aug. 1978
Richard D. McGunigle, Howard W. Jackson, and Robert R. Beavers Oct. 1978 73 p refs
(Contract F33615-75-C-2030; AF Proj. 3048)
(AD-A063974; HTL-K-West-D-1530; AFAPL-TR-78-84) Avail:

NTIS HC A04/MF A01 CSCL 20/6

A review of the state-of-the-art in ultra-violet conducting fiber optics and related system components was conducted with the objective of evaluating their potential applicability to solar blind, UV fire detection systems. From this basis, conceptual systems were developed and analyzed to assess the potential payoff of incorporating optical enhancement to improve the performance, and reduce the initial and life cycle cost, size and weight of such systems, and to effect detector circuit simplification and improvement in system reliability. Author (GRA)

N79-22883# Visidyne, Inc., Burlington, Mass.
TAILORED MODULATION TRANSFER FUNCTION AND THE APPLICATION TO DUAL BEAM INTERFEROMETRY
T. F. Zehnpfenning, S. Rappaport, W. P. Reidy, and O. Shepherd 27 Mar. 1978 31 p refs
(Contract F19628-77-C-0218; AF Proj. 2310)
(AD-A063884; VI-388A; AFGL-TR-78-0077; SR-1) Avail: NTIS HC A03/MF A01 CSCL 20/6

A technique for background suppression for use in Dual Beam Interferometers and other imaging systems is described. Background suppression is achieved by using pairs of optical systems whose modulation transfer functions match at low spatial frequencies but not at the higher frequencies which characterize a target. Various pairs of systems are discussed, and signal-to-RMS-clutter-leakages are calculated. Author (GRA)

N79-22884# Alabama A & M Univ., Normal.
IMAGE EVALUATION USING MODULATION TRANSFER FUNCTIONS FOR CASSEGRAINIAN-TYPE TELESCOPIC SYSTEMS
Frances L. Yen and Jerry R. Shipman May 1978 38 p refs
(Contract DAAK40-78-M-0022)
(AD-A063952) Avail: NTIS HC A03/MF A01 CSCL 20/6

Contents: Basic Concepts and Definition; Calculation of Transfer Functions; and Measuring Instruments and Techniques. GRA

N79-22885# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
FUNDAMENTAL LIMITATIONS OF OPTICAL TRACKERS M.S. Thesis
John M. Santiago, Jr. Dec. 1978 176 p refs
(AD-A064737; AFIT/GEO/EE/78-4) Avail: NTIS HC A09/MF A01 CSCL 17/8

A problem is considered to determine the tracking capabilities of an estimator, applied in optical sensing. The estimator tracks the centroid of a one-dimensional Gaussian-shaped intensity based on time-space point process measurements. The centroid assumes to move dynamically as a First Order Gauss-Markov process. Filter performance is described by steady-state upper and lower bounds on mean-square-error (MSE) which are evaluated as a function of two physically motivated parameters: average number of photons detected in a coherence time of centroid dynamics and mean square of the beam width. The parameters establish regions of operations where upper and lower bounds converge to the actual MSE. Results from the Monte-Carlo simulation demonstrates the bounds usefulness. Noise measurements from dark current or background radiation are included in the simulation. Results show that the filter is very sensitive to these measurements, resulting in very poor tracking. Ad hoc methods of filter tuning and residual monitoring are employed to improve tracking performance; results indicate that filter performance can be improved substantially through residual monitoring. Author (GRA)

N79-22886# Battelle Columbus Labs., Ohio.
ANALYSIS OF A MODEL FOR IR SUPPRESSION Final Report, 1 Apr. 1977 - 31 Jun. 1978
R. P. Kenan, G. Wolken, J. McCreery, R. Barnes, D. Applebaum, and G. Whitacre 29 Sep. 1978 57 p refs
(Contract F49620-77-C-0056; AF Proj. 2301)
(AD-A064548; AFOSR-79-0009TR) Avail: NTIS HC A04/MF A01 CSCL 17/4

Research directed to assessment of the role of radiationless, collisional de-excitation of excited CO2 and H2O in enhancing the effective extinction coefficient of lampblack smokes in air is described. It is found that, unless the CO2 or H2O is highly excited, the effect is negligible. Author (GRA)

N79-22887# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COHERENCE PROPERTIES OF BROADBAND OPTICAL FIELDS WITH APPLICATIONS TO WHITE-LIGHT SHEARING INTERFEROMETRY M.S. Thesis
Paul S. Idell Dec. 1978 113 p refs
(AD-A064404; AFIT/GEO/EE/78-1) Avail: NTIS HC A06/MF A01 CSCL 20/6

A free-space propagation model for broadband optical fields is developed based on a Karhunen-Loeve (KL) expansion of the time-varying portion of a coherence separable broadband optical envelope. The resulting model expansion provides an intuitively simple interpretation of the propagation of broadband fields, and allows the output field correlation to be easily calculated. The propagation model is applied to the analysis of a lateral shear AC interferometer, which has been used to measure the spatial phase variations of a white-light optical field envelope located at its input aperture. It is found that the interferometer's operation for broadband fields causes the phase which is measured by the interferometer to be related to a spatially filtered version of the aperture field. The propagation model is applied to the shearing interferometer's operation as a wavefront sensor in a phase-compensated imaging system, where the phase of the aperture field envelope has been disrupted by atmospheric turbulence. The turbulence-induced phase perturbation is modeled as a unit-modulus phase screen introduced at the aperture plane of the interferometer for each temporal mode of the field expansion. Author (GRA)

N79-22888# Utah State Univ., Logan. Center for Atmospheric and Space Sciences.
STUDY OF RADIATIVE SCATTERING CONCEPT OF PLUME INFRARED RADIATION OBSCURATION Final Report, 1 Aug. 1977 - 30 Oct. 1978
R. D. Harris, Keith Odell, G. G. Pippin, Stephen J. Young, and L. R. Martin Dec. 1978 37 p refs Prepared in cooperation with Aerospace Corp., El Segundo, Calif.
(Contract F49620-77-C-0121; AF Proj. 2301)
(AD-A065006; AFOSR-79-0039TR) Avail: NTIS HC A03/MF A01 CSCL 17/4

Theoretical and experimental studies were performed to measure the synergistic absorption of hot-gas radiation by an aerosol/absorbing gas mixture and to verify quantitatively the infrared absorption of carbon particles. Computer calculations for a pure scatterer/N2O absorbing gas mixture revealed a synergistic effect of only 10%. In carbon - N2O mixtures, synergism was negligible. Attenuation measurements were made for pure carbon and TiO2 aerosols, pure N2O samples, and the combination of each aerosol in N2O. In all cases, the net transmittance of the gas/aerosol was described by the simple product of the N2O alone and aerosol transmittances. No synergism were detected. Transmission calculations for carbon show it a very effective candidate for plume obscuration. Author (GRA)

N79-22889# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
FIBER OPTICS RECEIVER INTEGRATED CIRCUIT DEVELOPMENT Final Report, Jun. 1976 - Jul. 1978
Ben R. Elmer Dec. 1978 139 p
(Contract F33615-76-C-1275)
(AD-A064966; HONEYWELL-76SRC69; AFAL-TR-78-185)
Avail: NTIS HC A07/MF A01 CSCL 09/5

This report describes the development of the Fiber Optic Receiver Integrated Circuit (FORIC) from synthesis through analysis, layout, processing, packaging, and testing the 1050 parts that were delivered. Detailed test, burn-in, and qualification plans are also included. One of the highlights of this report is an Application Information section, written to inform users of the characteristics of the device that are not apparent from reading the specification. Author (GRA)

N79-22890# National Bureau of Standards, Washington, D. C. National Measurement Lab.
DETECTOR SPECTRAL RESPONSE FROM 350 TO 1200 nm USING A MONOCHROMATOR BASED SPECTRAL COMPARATOR

Antonio Corrons (Inst. de Optica, Madrid) and Edward F. Zalewski Dec. 1978 24 p refs
(PB-289897/1; NBS-TN-988) Avail: NTIS HC A02/MF A01 CSCL 20F

The method of relative spectral detector response measurement based on filters of known transmittance and a spectral irradiance standard lamp was used to measure the responsivity of a thermopile. The thermopile was then used in conjunction with a monochromator based spectral comparator to measure the relative spectral response from 350 to 1200 nm of several other detectors. Several auxiliary experiments to evaluate the accuracy of these techniques are described. The estimated accuracy of relative spectral response measurements using these techniques and this particular instrumentation was found to range from 3 to 7% depending upon the type of detector being measured and the spectral region under study. Finally, the effective transmittance of several filters was measured to evaluate the accuracy of the relative spectral detector response measurements. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-22891# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

VKI SHORT COURSE ON MAGNETOHYDRODYNAMIC ACCELERATORS AND GENERATORS

John F. Wendt, ed. May 1968 100 p refs Lecture held at Rhode-Saint-Genese, Belgium, 6-10 May 1968
(VKI-Lecture-Series-8) Avail: NTIS HC 05/MF A01

After an introduction to the fundamental concepts and equations of magnetohydrodynamics (MHD), the performance of various MHD accelerators and generators and their present day problem areas are discussed. Rectangular channel shapes and the axisymmetric models are included. Diagnostic techniques are treated with emphasis on microwave, magnetic, and electric probes. Continuous electrodeless and pulsed accelerators are presented. For individual titles, see N79-22892 through N79-22896.

N79-22892# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

FUNDAMENTAL EQUATIONS OF MHD

John F. Wendt *In its* VKI Short Course on Magnetohydrodyn. Accelerators and Generators May 1968 22 p refs (For primary document see N79-22891 13-75)
Avail: NTIS HC A05/MF A01

The fundamental magnetohydrodynamic equations are presented to study the mutual interactions between the velocity field and electromagnetic field of ionized gases. M.M.M.

N79-22893# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

PERFORMANCE OF MHD DEVICES AND PROBLEM AREAS

H. J. Ramm (ARO, Inc., Arnold Air Force Station, Tenn.) *In its* VKI Short Course on Magnetohydrodyn. Accelerators and Generators May 1968 22 p refs (For primary document see N79-22891 13-75)
Avail: NTIS HC A05/MF A01

Two magnetohydrodynamic devices are described: the channel flow or cross field devices where rectangular channels are used in which the magnetic field is normal to the externally imposed electric field, and both are normal to the flow direction and parallel to the walls; and the axis symmetric devices requiring a changing flow cross section for the production of magnetohydrodynamic effects. M.M.M.

N79-22894# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

INSTRUMENTATION

P. C. T. deBoer (Cornell Univ., Ithaca, N. Y.) *In its* VKI Short Course on Magnetohydrodyn. Accelerators and Generators May 1968 33 p refs (For primary document see N79-22891 13-75)
Avail: NTIS HC A05/MF A01

Plasma diagnostic techniques are treated with emphasis on microwave, magnetic, and electric probes. A probe of the hollow type is a useful instrument for measuring ion density in a flowing plasma. For high charge particle density, the probe functions as a flush probe. Three cases are presented: total collection, shearth thicker than boundary layer, sheath thinner than boundary layer. This allows for the use of the probe over a wide range of ion densities. M.M.M.

N79-22895# Litton Industries, Beverly Hills, Calif. Space Sciences Labs.

ELECTRODELESS MHD ACCELERATOR

G. R. Seemann *In* Von Karman Inst. for Fluid Dyn. VKI Short Course on Magnetohydrodyn. Accelerators and Generators May 1968 11 p refs (For primary document see N79-22891 13-75)
Avail: NTIS HC A05/MF A01

A description of the traveling wave concept is given and its behavior in an electrodeless magnetohydrodynamic accelerator is presented. A theoretical study on the effect of plasma in a magnetic field is described. Subsonic traveling wave accelerated tests were carried out and compared with the theoretical models. A subsonic plasma tunnel which is being used to evaluate reentry flight instrumentation in a known plasma environment was used for the tests. The wide range of plasma parameters attainable is of interest in evaluating electrostatic probes, microwave probes, and various antennas. M.M.M.

N79-22896# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

PULSED ACCELERATORS

John F. Wendt *In its* VKI Short Course on Magnetohydrodyn. Accelerators and Generators May 1968 9 p refs (For primary document see N79-22891 13-75)
Avail: NTIS HC A05/MF A01

Plasma flow processes in a slip-type traveling wave accleratator are presented. The degree to which one dimensional flow theory can be used in formulating the design criteria and scaling laws for the slip type traveling wave accelerator is discussed. A two stage high performance impulse technique for reentry simulation tests utilizing linear accelerators are described. Different techniques were used in an augmented shock tunnel to experimentally determine the useful testing time. M.M.M.

N79-22897*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY RESULTS IN THE NASA LEWIS H2-O2 COMBUSTION MHD EXPERIMENT

J. Marlin Smith 1979 11 p refs To be presented at the 18th Symp. on the Eng. Aspects of Magnetohydrodyn., Butte, Mont., 18-20 Jun. 1979
(NASA-TM-79135; E-9983) Avail: NTIS HC A02/MF A01 CSCL 20I

MHD (magnetohydrodynamic) power generation experiments were carried out in the NASA Lewis Research Center cesium-seeded H2-O2 combustion facility. This facility uses a neon-cooled cryomagndt capable of producing magnetic fields in excess of 5 tesla. The effects of power takeoff location, generator loading, B-field strength, and electrode breakdown on generator performance are discussed. The experimental data is compared to a theory based on one-dimensional flow with heat transfer, friction, and voltage drops. G.Y.

N79-22898# Indiana Univ. at Bloomington. Dept. of Chemistry.

MICROWAVE-SUPPORTED DISCHARGES Interim Technical Report

A. T. Zander (Cleveland State Univ.) 26 Jan. 1979 57 p refs Submitted for publication
(Contract N00014-76-C-0838; NR Proj. 051-622)
(AD-A064617) Avail: NTIS HC A04/MF A01 CSCL 20/9

The fundamental operation and analytical characteristics of microwave-supported gas discharges are discussed and reviewed. The development of microwave plasma is historically traced and their future impact on analytical spectroscopy is assessed.
Author (GRA)

N79-22899# California Univ., Berkeley. Electronics Research Lab.
PLASMA THEORY AND SIMULATION Quarterly Progress Report, 1 Jul. - 30 Sep. 1978
C. K. Birdsall, W. Fawley, Yu Jivan Chen, Douglas Harned, Jae Koo Lee, and Lee Buchanan 30 Sep. 1978 23 p refs
(Contracts N00014-77-C-0578; EY-76-S-03-0034)
(AD-A065157; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 20/9

Contents: Plasmas with Field Reversal; Simulations of Drift Cyclotron Instability; ES1 Code; Adaptation of ES1 to Use Post Processor ZED; 1 1/2d Particle-Fluid Hybrid Model for Lower Hybrid Drift Wave Instability; and RJET (Mini-User's Center) Development. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N79-22900 Duke Univ., Durham, N. C.
TRIPLET EXCITON DYNAMICS AND SPIN-LATTICE RELAXATION IN MTPA(TCNQ)2 Ph.D. Thesis
Stephen Ray Bondeson 1978 143 p
Avail: Univ. Microfilms Order No. 7906965

A model for the effects of triplet exciton dynamics on the nuclear spin-lattice relaxation is presented. Excitons are considered as random-walking particles on a finite, one-dimensional lattice and as interacting with the nuclear magnetic moments through both dipole-dipole and Fermi contact mechanisms. The model is specifically applied to the phi 3CH3As salt of tetracyanoquinodimethane for which the orientation and temperature dependencies of tau 1-1 are calculated. An extension to the calculation of the correlation function and computer simulations are discussed. Dissert. Abstr.

N79-22901 Princeton Univ., N. J.
MAGNETIC REORIENTATION AND TACTOIDAL SHELL DEFECTS IN POLY(GAMMA-BENZYL GLUTAMATE) LIQUID CRYSTALS Ph.D. Thesis
Robert W. Filas 1979 143 p
Avail: Univ. Microfilms Order No. 7907970

The magnetic reorientation of polygamma-benzyl glutamate (PBG) liquid crystals was investigated using NMR (Nuclear Magnetic Resonance), viscometric, and optical methods. The experiments indicate that the mechanism of reorientation becomes complex above a critical rotation angle, theta sub o = theta sub c. The observed changes in the physical properties of the system under such conditions are all consistent with a model in which the PBG molecules are not perfectly aligned with the magnetic field at equilibrium. The consequence of such a situation in a magnetic reorientation experiment is to make possible the conditions for counterrotating regions to develop when theta sub o > theta sub c. The interaction of such domains can disrupt the structure of the liquid crystal and decrease the original degree of order of the polypeptide with commensurate changes in the NMR signal, apparent viscosity, and optical properties. Dissert. Abstr.

N79-22902 Brown Univ., Providence, R. I.
THE ELECTRICAL CONDUCTIVITY OF GERMANIUM AS A FUNCTION OF OPTICALLY INJECTED CARRIER DENSITY AND TEMPERATURE Ph.D. Thesis
Jerry Richard Meyer 1978 175 p
Avail: Univ. Microfilms Order No. 7906586

The effects of carrier-carrier scattering on the transport properties of high-density electron-hole plasmas in germanium were studied both experimentally and theoretically. Experimentally, the dc electrical conductivities of nearly uniform, optically-injected bipolar plasmas in high-purity, single crystals of germanium were measured for a broad range of carrier densities and temperatures. Concurrent measurements of the absorption of 3.39 micrometer radiation due to inter-hole-band transitions aided the calibration of the carrier densities at some temperatures. The Lindhard q-dependent screening approximation was used in some of the calculations instead of the constant Debye-Huckel form. New analytic approximations (accurate to within 1 1/2%) are presented for the Lindhard screening which are general with respect to both wave vector and degeneracy. Dissert. Abstr.

N79-22903 Brown Univ., Providence, R. I.
DISLOCATION DAMPING IN LITHIUM-FLUORIDE AT LOW TEMPERATURES; STUDIES BY ULTRASONIC AND HEAT PULSE METHODS Ph.D. Thesis
Marcos Leon Rodriguez 1978 250 p
Avail: Univ. Microfilms Order No. 7906604

The results of measurements of the absolute ultrasonic attenuation of lithium fluoride crystals in irradiated, annealed and plastically deformed states at 3.4 K are presented. The dislocation contribution to the ultrasonic attenuation in crystals is directly related to the dynamic properties of the dislocations present, and measurements of the frequency and stress amplitude dependence of the attenuation coefficient are used to ascertain which damping mechanisms of the motion of dislocations are most important in a particular temperature range. A technique was developed for measuring the attenuation coefficient of ultrasonic waves propagating in a crystal; a superconducting bolometer evaporated on one of the faces of the sample, and operating at a temperature near the midpoint of its normal to superconducting transition, is used to record small changes in the temperature of the sample as the ultrasonic wave propagates and is attenuated. Dissert. Abstr.

N79-22904 Brown Univ., Providence, R. I.
NITROGEN-14 NUCLEAR QUADRUPOLE RESONANCE STUDY OF ORGANIC MOLECULAR CRYSTALS Ph.D. Thesis
Saligrama Narasimhamurthy Subbarao 1978 138 p
Avail: Univ. Microfilms Order No. 7906615

The nitrogen-14 nuclear quadrupole resonance (NQR) spectra of some 85 organic compounds including compounds of biological and pharmacological importance are reported and analyzed in the framework of the semi-empirical Townes and Dailey theory. The compounds investigated fall into the following groups; (1) substituted piorobenzenes, (2) hydroxypyrimidines, (3) benzenesulfonamides, (4) sulfanilamides, and (5) liquid crystals. Dissert. Abstr.

N79-22905 Wayne State Univ., Detroit, Mich.
THE INSTABILITIES OF SUPERCONDUCTING Pb AND Sn FILMS WITH TRANSPORT CURRENTS Ph.D. Thesis
Tzer-Fu Huang 1978 122 p
Avail: Univ. Microfilms Order No. 7908924

The instability current at which the transition from the flux-flow state to the normal state occurs was calculated. Experimental results for the magnetic field-and temperature-dependences of the instability current of Pb and Sn films are in good agreement with theory. The I-V characteristics of these samples in parallel magnetic fields were investigated. The flux-flow-like state at higher temperatures: T is greater than o.78 T sub c for Sn and T i greater than 0.2 T sub c for Pb, respectively. From the measurements of the critical current as a function of the magnetic field, the temperature, and the magnetic field direction, it is concluded that the instability is primarily determined by the current, not by the voltage. Dissert. Abstr.

N79-22906 State Univ. of New York at Stony Brook.
TRANSPORT PROPERTIES OF ANOMALOUS SYSTEMS: PART A. ULTRA THIN Bi WIRES: PART B. A15 COMPOUNDS Ph.D. Thesis
Michael A. Gurvitch 1978 253 p
Avail: Univ. Microfilms Order No. 7908401

In the first part of this work, some theoretical aspects of the Quantum Size Effects (QSE) are discussed, namely some basics of the one-dimensional QSE and electron scattering on lattice vibrations in the presence of the QSE in both two- and one-dimensional cases. The experimental methods of making very thin (down to approximately 2000 A) single crystal wires of Bi is described. In the second part, the resistivity of superconducting compounds of the A15 group (Nb3Sn, Nb3Al, Nb3Ge, Mo3Ge) is studied in as made and damaged films. The parallel resistor mechanism capable of explaining the high temperature behavior is discussed and compared with other explanations for

the family of curves obtained after successive irradiations of the same sample. Low temperature behavior is also studied for different A15's. Dissert. Abstr.

N79-22907 Pennsylvania Univ., Philadelphia.
A STUDY OF THE INTERACTION OF ADSORBED CARBON MONOXIDE WITH SURFACES OF NICKEL AND COPPER USING ANGLE RESOLVED PHOTOEMISSION AND SYNCHROTRON RADIATION Ph.D. Thesis
Christopher Lovejoy Allyn 1978 206 p
Avail: Univ. Microfilms Order No. 7908700

The orientation of the axis of CO molecules adsorbed on Ni(100)m Bu(111)m abd Cu(100) surfaces was determined. The determiniation is based on measurements of the angle resolved photoemission from these systems using a new electron energy analyzer system constructed specifically for this work. The incident radiation was polarized synchrotron radiation with photon energies between 15 and 50 eV. It was found that by comparing the measured emission from the adsorbate induced level with the gas phase photoemission of the analogous level, the CO axis could be shown to be oriented with 20 deg of the surface normal for each of the three surfaces investigated. This uncertainty is consistent with expected tilting of the axis due to thermal vibrations. Dissert. Abstr.

N79-22908 Pennsylvania Univ., Philadelphia.
THE RIGID WANNIER FUNCTION MODEL OF LATTICE DYNAMICS IN ALKALI METALS Ph.D. Thesis
Richard William Kalkan, Jr. 1978 207 p
Avail: Univ. Microfilms Order No. 7908752

The rigid Wannier function approximation for alkali metals is examined. Rigid Wannier functions are assumed to move exactly with their centers of localization and not to change form. This approximation is an attempt to reproduce the electron density without performing ab initio calculations. Two different phenomena are examined. For the first the electron density and potential of a vacancy in the alkali metals are determined. For the second the lattice dispersion curves for the alkali metals are calculated. Feynman's theorem is modified to give the force on an ion, and the crystal is decomposed into cells in order to account for significant three-center terms. From the dispersion curves the longitudinal velocity of sound in three high symmetry directions is calculated and a Gruneisen constant determined. Dissert. Abstr.

N79-22909 Pennsylvania Univ., Philadelphia.
RENORMALIZATION-GROUP STUDY OF THE POTTS MODEL WITH APPLICATIONS TO RANDOM NETWORKS Ph.D. Thesis
Chandan Dasgupta 1978 203 p
Avail: Univ. Microfilms Order No. 7908719

Renormalization-group techniques are used to study the s-state Potts model and a number of nonthermodynamic random networks whose properties can be obtained from the thermodynamics of the Potts model. A variational position-space renormalization group transformation is employed to analyze the critical behavior of the s-state Potts model on a square lattice. For $s=3$ and $s=4$, this transformation correctly predicts a continuous phase transition. The bond percolation problem in which nearest-neighbor bonds on a lattice are randomly connected with probability p and vancant with probability (1-p) is related to the s yield 1 limit of the s-state Potts model. The critical exponents for percolation on a square lattice are calculated. The results obtained in this way are in excellent agreement with series-expansion and Monte-Carlo results. The critical behavior of a random resistor network in which nearest-neighbor pairs of lattice sites are randomly connected with bonds of conductance with probability p and with bonds of zero conductance with probability is studied. Dissert. Abstr.

N79-22910 Pennsylvania State Univ., University Park.
FIRST PRINCIPLES PSEUDOPOTENTIAL CALCULATIONS OF ELECTRONIC AND ATOMIC PROPERTIES OF SOLID AND LIQUID ALKALI METALS Ph.D. Thesis
Richard Salisbury Day 1978 116 p
Avail: Univ. Microfilms Order No. 7909056

First principles fully nonlocal pseudopotentials are constructed for the alkali metals Li, Na, K. The orthogonalization hole contribution to the pseudopotential is treated exactly and comparison with approximate treatments shows significant differences. The pseudopotentials are used to calculate various solid and liquid properties of these alkalis. The phonon spectra and elastic shear constants are calculated for the solid metal. The liquid structure factor curve is calculated using a Monte Carlo technique. Electrical resistivities of the liquid alkali metals are also calculated. The electronic transport properties are calculated for the first time. A pseudo-atom model is suggested as a more appropriate means of describing the core-electron states used in constructing the pseudopotentials. Dissert. Abstr.

N79-22911 Oregon Univ., Eugene.
CALCULATION OF LANDAU LEVELS AND ELECTRONIC PROPERTIES OF BISMUTH Ph.D. Thesis
Kyun Hyun Choi 1978 143 p
Avail: Univ. Microfilms Order No. 7907449

An energy band model for electrons in bismuth is derived using the k-p method up to the third order. The version of the model for zero magnetic fields gives very good fits to several experimental results (de Haas-van Alphen effect, cyclotron resonance mass, magnetic surface resonance field, and limiting-point cyclotron resonance mass) as a function of the orientation of the magnetic field. A calculation of the Landau levels is made by adding the magnetic field and spin magnetic moment to the energy band model. The resulting levels are the most accurate and general yet derived. The levels are used to calculate de Haas-van Alphen frequency, cyclotron resonance mass, Landau level spin splitting, quantum limit shifts, magnetoreflection, and high and low field magnetization. Very good agreement with these experiments is obtained and the 14 most important band parameters are evaluated. Dissert. Abstr.

N79-22912 Notre Dame Univ., Ind.
QUASIPARTICLE INTERFERENCE PHENOMENA IN THICK SUPERCONDUCTING ALUMINUM FILMS, AND PROXIMITY EFFECTS IN THIN ALUMINUM AND SILVER FILMS Ph.D. Thesis
Zheong G. Khim 1979 133 p
Avail: Univ. Microfilms Order No. 7908382

Quasiparticle interference phenomena in thick Al films ($0.6 < \text{or} = d \text{ sub } 1 < \text{or} = 3.1$ microns) backed by thin Pb (d sub 2 approximately equal to 0.13 microns) produce oscillatory level structure in the tunneling density of states because of Andreev scattering at the Al/Pb interface. Observed virtual-state level spacings are employed to obtain precise determinations of the dressed Fermi velocity V sub f and the electron-phonon renormalization parameter Z sub o for films with pronounced /111/ fiber textures. Although the proximity effect systematically enhances observed energy gap values as Al film thicknesses decreases, V sub F and Z sub o remain constant at (1.30 + or - 0.01) x 10 to the 6th power microns/sec and 1.56 on the scale of thickness employed in the experiment. A BCS coherence length Xi sub o (Al) = (1.54 + or - 0.05) microns and a pairing potential decay length (at T = 0.95 K) of 1/K (A1) = 1.47 + or - 0.07) microns were inferred. Dissert. Abstr.

N79-22913 Michigan Univ., Ann Arbor.
TWO PROBLEMS RELATED TO THE ELECTRON-HOLE LIQUID IN GERMANIUM Ph.D. Thesis
Douglas Kevin Fairobent 1978 59 p
Avail: Univ. Microfilms Order No. 7907069

Two problems related to the electron-hole liquid in germanium are discussed. The first is an investigation into the nature of the transition from insulating to conducting behavior in the gas which coexists with the liquid. The second problem discussed concerns the recombination luminescence in doped germanium. The impurities are taken to lie on a lattice of Wigner-Seitz spheres. The energy of the liquid per unit cell and the energy of an isolated donor are calculated via the density-functional theory. Dissert. Abstr.

N79-22914 Johns Hopkins Univ., Baltimore, Md.
FUNDAMENTAL MAGNETIC BEHAVIOR OF ULTRA-THIN EPITAXIAL IRON FILMS Ph.D. Thesis
Scott Whitfield Duncan 1979 149 p
Avail: Univ. Microfilms Order No. 7906449

In order to test the different theories of ferromagnetism,

measurements of the Hyperfine Magnetic Field in ultra-thin films of Fe were made. The films' thicknesses were from 20 A to 100 A. The range in temperature was from 4.2 K to the Curie point at about 1040 K. The measurements consisted of data taken in the low temperature spin wave region, determination of the Curie point as a function of thickness, and measurements to find the magnetization as a function of depth. Dissert. Abstr.

N79-22915 Wayne State Univ., Detroit, Mich.
ZONE REFINING AND SINGLE CRYSTAL GROWTH OF CUPROUS OXIDE Ph.D. Thesis
Anand Swaroop Kakar 1978 162 p
Avail: Univ. Microfilms Order No. 7908928

A method of purification and single crystal growth of cuprous oxide by an R. F. induction heating float zone technique was developed. Ingots of 5/1 inches diameter and 6 inches long, with three to six columnar crystals extending the entire length of the rod, were prepared. After etching, these rods can be viewed as red by transmitted visible light. The zone refined Cu2O samples were characterized by chemical analysis and by the measurement of optical absorption coefficients, vibrational modes in the far IR, Raman scattering, and resistivity. Dissert. Abstr.

N79-22916 State Univ. of New York, Buffalo.
X-RAY CRYSTAL STRUCTURE ANALYSIS OF CELLULOSE II, CELLULOSE TRIACETATE I, AND DEXTRAN Ph.D. Thesis
Arthur John Stipanovic 1979 161 p
Avail: Univ. Microfilms Order No. 7906753

The crystal structure of cellulose triacetate 1 (CTA 1), obtained by heterogeneous acetylation of ramie cellulose 1, was determined by a combined X-ray diffraction and stereo chemical model analysis. The crystal structure of regenerated cellulose 2 (Fortisan) was solved by a combined stereochemical packing refinement and X-ray diffraction analysis. Attempts to obtain crystalline and oriented samples of synthetic linear dextran were unsuccessful although two polymorphs, denoted as dextrans G and F, were obtained which crystallized in an unoriented manner.
Dissert. Abstr.

N79-22917# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AGARD-VKI LECTURE SERIES ON GAS-SURFACE INTERACTIONS. PART 1: THEORY, VOLUME 1
Feb. 1968 272 p refs Lecture held at Rhodes-Saint-Genese, Belgium, 19 Feb. 1968 - 1 Mar. 1968
(VKI-Lecture-Series-4-Pt-1-V-1) Avail: NTIS HC A12/MF A01

After a review of solid and surface properties, both the classical and quantum models proposed to explain the gas-surface interaction problem are presented. Emphasis is placed on the most recent results, and both analytical and numerical studies are included. For individual titles, see N79-22918 through N79-22922.

N79-22918# Massachusetts Inst. of Tech., Cambridge.
THEORY OF THE SOLID SURFACE, SECTION A
L. Trilling *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions. Pt. 1: Theory, Vol. 1 Feb. 1968 63 p refs (For primary document see N79-22917 13-76)
Avail: NTIS HC A12/MF A01

The nature of gas-surface interactions is qualitatively discussed with emphasis on intermolecular forces. Gas-gas interactions, both elastic and inelastic, the binding energies in a cy crystal, and gas-solid atom interactions are covered. Other topics addressed include crystal structure and lattice vibrations and the application of F-D vi statistics to an assembly of free electrons.
J.M.S.

N79-22919# Air Force Office of Scientific Research, Arlington, Va. Mechanics Div.
THEORY OF THE SOLID SURFACE, SECTION B
M. Rogers *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions. Pt. 1: Theory, Vol. 1 Feb. 1968 13 p refs (For primary document see N79-22917 13-76)
Avail: NTIS HC A12/MF A01

The interatomic forces that exist within a solid are discussed. Factors covered include: the electrostatic nature of the interatomic force; stable equilibrium and dissociation energy; classification of solids; and crystal structure. Exchange forces and saturation property of interatomic forces and diffraction are briefly considered.
J.M.S.

N79-22920# Massachusetts Inst. of Tech., Cambridge.
CLASSICAL THEORY OF GAS-SURFACE INTERACTIONS, SECTION C
L. Trilling *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions. Pt. 1: Theory, Vol. 1 Feb. 1968 45 p refs (For primary document see N79-22917 13-76)
Avail: NTIS HC A12/MF A01

The molecular theory of accommodation is considered. It is shown that refinements are necessary to improve the calculation of accommodation. A model of the three body problem is outlined. A lattice model which gives plausible energy exchange predictions and a geometrical model which shows promise as a correlator of data on scattering direction distribution are presented. These models are based on classical interaction mechanisms; some potential generalizations to quantum models are suggested.
J.M.S.

N79-22921# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
CLASSICAL THEORY FOR THE INTERACTION OF GAS ATOMS WITH SOLID SURFACES Ph.D. Thesis
Roderick Matheson Logan *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions. Pt. 1: Theory, Vol. 1 Feb. 1968 117 p refs (For primary document see N79-22917 13-76)
Avail: NTIS HC A12/MF A01

A classical theory for the interaction of gas atoms with solid surfaces is presented. The principal assumptions of the model used are: (1) the surface atoms involved in the collisions can be represented as independent one dimensional oscillators; (2) the gas atoms interact with the surface through a stationary square-well attractive potential and an exponential repulsive potential; (3) the surface is flat so that the tangential velocity component of the gas atom is unchanged; (4) the surface oscillators have an equilibrium energy distribution at the temperature of the solid. An approximate closed-form expression is obtained for the angular distribution of particle flux for a monoenergetic atomic beam scattered from a surface. Author

N79-22922# Royal Aircraft Establishment, Farnborough (England). Materials Dept.
QUANTUM THEORY OF GAS-SURFACE INTERACTIONS
D. M. Gilbey *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions. Pt. 1: Theory, Vol. 1 Feb. 1968 22 p refs (For primary document see N79-22917 13-76)
Avail: NTIS HC A12/MF A01

A quantum mechanical approach to gas-surface interaction phenomena is presented. Methods discussed include: steady perturbations; time dependent perturbations; variation of constants distorted wave approximation; and semiclassical treatment. A list of models for which en eigenfunctions and matrix elements are available is given. The results of various quantum and classical perturbation theories are given. Other topics discussed include: momentum accommodation; multiphonon transfers; anharmonicity; near-classical expansion; placzek expansion; and sticking coefficient.
J.M.S.

N79-22923# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AGARD-VKI LECTURE SERIES ON GAS-SURFACE INTERACTIONS. PART 1: THEORY, VOLUME 2
Feb. 1968 152 p refs Lecture held at Rhodes-Saint-Genese, Belgium, 19 Feb. 1968 - 1 Mar. 1968
(VKI-Lecture-Series-4-Pt-1-V-2) Avail: NTIS HC A08/MF A01

Numerical studies of gas-surface interactions are presented. The utilization of an analog computer to study these interactions is reported. The mechanics of momentum and energy transfer, and the interdependence of the accomodation coefficients are described. For individual titles, see N79-22924 through N79-22925.

N79-22924# Air Force Office of Scientific Research, Arlington, Va. Mechanics Div.

NUMERICAL STUDIES OF GAS: SURFACE INTERACTIONS, SECTION E

M. Rogers *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions. Pt. 1: Theory, Vol. 2 Feb. 1968 6 p (For primary document see N79-22923 13-76)
Avail: NTIS HC A08/MF A01

Research work in the field of gas-surface interactions is reported. The use of the analog computer is studied to investigate the detailed motion of a gas and a lattice during interactions. M.M.M.

N79-22925# Air Force Office of Scientific Research, Arlington, Va.

GAS-SURFACE PHENOMENA AND THE ANALOG COMPUTER

M. Rogers *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions. Pt. 1: Theory, Vol. 2 Feb. 1968 138 p refs (For primary document see N79-22923 13-76)
Avail: NTIS HC A08/MF A01

Various gas atom-solid interactions were studied and the chemisorption and physorption of some models were described. The utlization of an analog computer to ellucidate some of the results of these interactions are presented. The energy exchange between a gas particle and a solid atom was considered with a zero degree temperature wall. The results for a single atom wall that was initially at rest are presented, and also, to a lesser extent, for a vibrating wall atom, and a multi-atom wall. It was concluded that the experimental surface material and state must be known before any firm assessment can be made between predicted values of the accomodation coefficient and experimental data. M.M.M.

N79-22926# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

AGARD-VKI-LECTURE SERIES ON GAS-SURFACE INTERACTIONS. PART 2: EXPERIMENT

Feb. 1968 92 p refs Lecture held at Rhode-Saint-Genese, Belgium, 19 Feb. - 1 Mar. 1968
(VKI-Lecture-Series-4-Pt-2) Avail: NTIS HC A05/MF A01

Studies are presented on high energy beams, experimental methods in gas-surface interactions, and time-of-flight analysis of atomic and molecular beams. Electron diffraction investigations of three dimensional crystals are also discussed. For individual titles, see N79-22927 through N79-22930.

N79-22927# Laboratoire Mediterraneen de Recherches Thermodynamiques, Nice (France).

HIGH ENERGY BEAMS

F. M. Devienne *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions, Pt. 2 Feb. 1968 11 p (For primary document see N79-22926 13-76)
Avail: NTIS HC A05/MF A01

The production and instrumentation of high energy molecular beams are discussed, as well as the process for obtaining molecular beams with energy higher than 10 eV. The intensity, speed repartition, and composition of the beams were studied, along with molecular beam reflection off solid surfaces. J.A.M.

N79-22928# Karlsruhe Univ. (West Germany).

EXPERIMENTAL METHODS IN GAS-SURFACE INTERACTIONS

O. F. Hagena *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions, Pt. 2 Feb. 1968 11 p refs (For primary document see N79-22926 13-76)
Avail: NTIS HC A05/MF A01

Experimental methods for studing gas surface interactions included thermal cell experiments on energy exchange and molecular beam experiments using effusive beams. Supersonic molecular beams were also studied, emphasizing beam characteristics, isentropic free jet expansion, and intensity and speed distribution. J.A.M.

N79-22929*# Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.

TIME-OF-FLIGHT VELOCITY ANALYSIS OF ATOMIC AND MOLECULAR BEAMS

Otto F. Hagena and Ashok K. Varma *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions, Pt. 2 Feb. 1968 25 p refs Sponsored by NASA (For primary document see N79-22926 13-76)
Avail: NTIS HC A05/MF A01 CSCL 20L

Conditions required for resolving a given beam speed distribution were evaluated by calculating the time-of-flight (TOF) signal for a finite open time of the beam shutter. Design criteria for a beam chopper and detection system are discussed in terms of the resolution, the range of speeds to be measured, and the optimum signal to noise ratio. A TOF system for detection of high intensity molecular beams with large speed ratios, as well as for low intensity scattered beams, is described. Experimental results are presented. J.A.M.

N79-22930# Air Force Office of Scientific Research, Arlington, Va.

VIEWING THE SURFACE

M. Rogers *In* Von Karman Inst. for Fluid Dyn. AGARD-VKI Lecture Ser. on Gas-Surface Interactions, Pt. 2 Feb. 1968 17 p refs (For primary document see N79-22926 13-76)
Avail: NTIS HC A05/MF A01

Electron diffraction was used to determined the structure of three dimensional crystals. Three types of diffraction were considered: (1) low energy electron diffraction, (2) high energy electron diffraction, and (3) field electron mission microscopy. J.A.M.

N79-22931*# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.

A STUDY TO INVESTIGATE THE CHEMICAL STABILITY OF GALLIUM PHOSPHATE OXIDE/GALLIUM ARSENIDE PHOSPHIDE Final Report

Gordon J. Kuhlman Washington NASA Apr. 1979 82 p refs
(Contract NAS1-15101)
(NASA-CR-3120; C77-1046/501) Avail: NTIS HC A05/MF A01 CSCL 20L

The elemental composition with depth into the oxide films was examined using secondary ion mass spectrometry. Results indicate that the layers are arsenic-deficient through the bulk of the oxide and arsenic-rich near both the oxide surface and the oxide-semiconductor interface region. Phosphorus is incorporated into the oxide in an approximately uniform manner. The MIS capacitor structures exhibited deep-depletion characteristics and hysteresis indicative of electron trapping at the oxide-semiconductor interface. Post-oxidation annealing of the films in argon or nitrogen generally results in slightly increased dielectric leakage currents and decreased C-V hysteresis effects, and is associated with arsenic loss at the oxide surface. The results of bias-temperature stress experiments indicate that the major instability effects are due to changes in the electron trapping behavior. No changes were observed in the elemental profiles following electrical stressing, indicating that the grown films are chemically stable under device operating conditions. Author

N79-22932# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Physics.

AN INTRODUCTION TO LATTICE GAUGE THEORY AND SPIN SYSTEMS

John B. Kogut Feb. 1979 236 p refs
(Grant NSF PHY-77-25279)
(ILL-(TH)-79-4) Avail: NTIS HC A11/MF A01

Phase diagrams and critical points of continuous transitions are stressed as the keys to understanding the character and continuum limits of lattice theories. Concepts such as duality, kink condensation and the existence of a local, relativistic field theory at a critical point of a lattice theory are illustrated in a discussion of the two dimensional Ising model. Theories with exact local (gauge) symmetries are introduced following F. Wegner's Ising lattice gauge theory. Its gauge invariant loop correlation function is discussed and the three dimensional model is studied. The renormalization group of the two dimensional planar model is presented as an illustration of a phase transition driven by the condensation of topological excitations. Parallels are drawn to abelian lattice gauge theory in four dimensions. Non-abelian gauge theories are introduced and the possibility of

quark confinement is discussed. Asymptotic freedom of O(n) Heisenberg spin systems in two dimensions is verified and is explained in simple terms. The direction of present-day research is briefly reviewed. A.R.H.

N79-22933*# California Univ., San Diego, La Jolla. Dept. of Applied Physics and Information Science.
SUPERCONDUCTIVITY IN TERNARY MOLYBDENUM SULFIDES Final Report
H. L. Luo [1978] 29 p refs
(Grant NsG-3101)
(NASA-CR-158345) Avail: NTIS HC A03/MF A01 CSCL 20L

Three research papers are presented: (1) Superconductivity in Th-Zr Alloys; (2) Superconductivity in Pd-Si-H(D) alloys; and (3) Low Temperature Specific Heat of Amorphous Pd-Si Alloys. G.Y.

N79-22934*# Pittsburgh Univ., Pa. Dept. of Chemistry.
STUDIES OF MAGNETOSTRICTION AND SPIN POLARIZED BAND STRUCTURES OF RARE EARTH INTERMETALLICS Final Report
W. E. Wallace Apr. 1979 29 p
(Grant NsG-3168)
(NASA-CR-158517) Avail: NTIS HC A03/MF A01 CSCL 20L

Anisotropic magnetostriction measurements of R6Fe23, R = (Tb, Dy, Ho, and Er) were carried out from 77 K to room temperature. Magnetic fields up to 2.1 Tesla were applied. All the compounds exhibited large magnetostrictions at 77 K, the largest effect being obtained for Tb6Fe23. Saturation magnetostriction values for the compounds were also determined for 77 K and room temperature. Results of the temperature dependence of magnetostriction for Er6Fe23 are in good agreement with Callen and Callen's single ion theory. Therefore, the main sources of magnetostriction in this compound is the Er ion. The spin-up and spin-down electronic energy bands, the density of states and the magnetic moments of YCo5, SmCo5, and GdCo5 were calculated by the spin polarized augmented plane wave technique. The calculations obtained show the origin of the moment, provide good estimates of its magnitude and variation, and the reasons for those variations. They also show the important role of partial charge transfer and of d-d electronic coupling. Calculations for LaNi5 and GdNi5 systems are discussed. A.R.H.

N79-22935# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELECTRICAL EFFECTS OF THREE DIFFERENT ENCAPSULANTS ON ION IMPLANTED GaAs M.S. Thesis
Simeon Dewey Breault Dec. 1978 63 p refs
(AD-A064362; AFIT/GE/EE/78-19) Avail: NTIS HC A03/MF A01 CSCL 20/12

A comparative study was done of the effectiveness of three different encapsulants for annealing ion-implanted GaAs. The three encapsulants studied were pyrolitic Si3N4 and SiO2, and plasma Si3N4. The study was limited to magnesium and sulfur implants done at room temperature with an implant energy of 120 keV. The implants were made into Cr-doped, semi-insulating substrates to doses ranging from 3 times 10 to the 12th power to 10 to the 15th power ions/sq cm Annealing was done in a flowing H2 atmosphere at 850 C for 15 minutes. Comparisons of effectiveness were made on the basis of electrical activation efficiency and electrical profile measurements which were taken using a guarded Van der Pauw measurements system. There was not a great deal of difference in the observed electrical activation efficiencies produced by the three different encapsulants. Plasma Si3N4 caps generally produced the highest activations, but were prone to pitting during annealing. The three encapsulants produced nearly identical electrical profiles, both for Mg and S implants. Contrary to previous studies, pyrolitic SiO2 caps produced higher activations than pyrolitic Si3N4 caps for some doses of the S implants. Author (GRA)

N79-22936# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CATHODOLUMINESCENCE ON THE EFFECTS OF Te IMPLANTATION AND LASER ANNEALING IN GALLIUM ARSENIDE M.S. Thesis
Ronald L. Lusk Dec. 1978 65 p refs
(AD-A064761; AFIT/GEP/PH/78D-8) Avail: NTIS HC A04/MF A01 CSCL 20/12

The United States Air Force uses devices which must operate in high temperature environments where intrinsic (pure) semiconductors do not perform well. With the intentional addition of impurity ions (doping) into the lattice of a crystal, the semiconductor gallium arsenide (GaAs) should have the electrical properties required for operation in the environments mentioned above. Gallium arsenide is an intermetallic compound formed from a group III element (gallium) and a group V element (arsenic). It crystallizes in the zinc blende structure and has physical properties which are similar to those of the covalent group IV semiconductors, germanium and silicon. The electrical properties, such as high electron mobility, have made GaAs very useful in many technical applications. However, the promise that GaAs shows for use in future devices, such as microwave devices, is based upon the ability to provide the necessary impurity concentrations in the pure crystal. GRA

N79-22937# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
INVESTIGATION OF INTERFACE STATES USING METAL-OXIDE-SILICON TRANSISTORS AND PULSE GATE TECHNIQUES. VOLUME 1: HALL EFFECTS MEASUREMENTS Final Report
Jan Whitefield and H. D. Southward Aug. 1978 292 p refs 2 Vol.
(Contract F29601-75-C-0036)
(AD-A064143; AD-E200213; EE-247(77)AF-352-1-Vol-1; AFWL-TR-77-140-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 09/1

A single metal-oxide-silicon chip was designed containing capacitors for capacitance-voltage (C-V) and devices for Hall effect measurements on the channel region of a metal-oxide-silicon field effect transistor. These two measurements provide data to calculate interface state density (Nss) in the mid gap region and near the band edges as functions of surface potential. Both Hall and conductivity mobility are calculated. It was found that Nss increases with total gamma radiation dose in the mid gap region but may either increase or decrease near the band edges, implying that interface states may arise from different mechanisms. Dangling bond and oxygen deficiency models are discussed as pertaining to possible mechanisms. Mobility versus surface potential demonstrate consistent results. Strongly inverted device channels yield mobilities which are very insensitive to radiation, indicating predominance of carrier-carrier scattering. But lightly inverted channels demonstrate that mobility is highly dependent upon radiation, indicating predominance of carrier-interface scattering. Author (GRA)

N79-22938# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
INVESTIGATION OF INTERFACE STATES USING METAL-OXIDE-SILICON TRANSISTORS AND PULSE GATE TECHNIQUES. VOLUME 2: PULSE FIELD EFFECTS MEASUREMENTS Final Report
Jan Whitefield and H. D. Southward Aug. 1978 96 p refs 2 Vol.
(Contract F29601-75-C-0036)
(AD-A064094; AD-E200214; EE-247(77)AF-352-1-Vol-2; AFWL-TR-77-140-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 09/1

The pulsed field effect technique is a measurement of the surface conductance of a semiconductor under the influence of a transverse electric field and was used to investigate surface states and interface states at the silicon-oxide interfaces. The investigation studied whether the pulsed field effect technique could be used to detect fast interface and regions close to the valence and conduction band edges. These states are able to exchange charge with the bands relatively fast, as compared to those which are closer to the center of the energy band gap. The effects of total ionizing radiation dose on interface state density and induced oxide charge were investigated. This work resulted in the development of a pulsed field effect technique which determines the interaction of fast interface states with the channel conductance of the MOSFET. It scans a portion of

the silicon band gap not obtainable using any other simple interface state analysis technique. Data which indicate that there are correlations between interface state density before irradiation and the radiation induced oxide charge are presented. Author GRA

N79-22939# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CATHODOLUMINESCENCE OF GERMANIUM IMPLANTED GALLIUM ARSENIDE AND THE EFFECTS OF LASER ANNEALING M.S. Thesis
James H. Walcher Dec. 1978 75 p refs
(AD-A064328; AFIT/GEP/PH/78D-16) Avail: NTIS HC A04/MF A01 CSCL 20/12

The primary objective of this study was to characterize experimental laser annealed samples using cathodoluminescence. Ten Cr-doped (SI) GaAs samples were studied. These samples included an unimplanted-unannealed sample, several unimplanted but laser annealed samples, Ge implanted thermally annealed and laser annealed samples, and a Ge implanted unannealed sample. The results indicated the experimental laser annealed samples to be partially or completely unannealed. The laser annealed samples were generally characterized by weak luminescence with peaks at 1.514 eV due to unresolved excitons, 1.488 eV attributed to ZnAs, and 1.469 eV (damage related). It was further observed that in the thermally annealed samples, the dominant peak was noted at 1.488 eV instead of the expected 1.478 eV peak previously associated with Ge. Finally, the unannealed sample spectra emissions were characterized by a 1.493 eV peak attributed to CAs, and in all non-laser annealed samples a 1.36 eV peak attributed to CuGa was observed. GRA

N79-22940# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PHOTOLUMINESCENCE OF GALLIUM INDIUM ARSENIC PHOSPHIDE M.S. Thesis
Jamie G. G. Varni Sep. 1978 95 p refs
(AD-A064066; AFIT/GEP/PH/78D-14) Avail: NTIS HC A05/MF A01 CSCL 20/12

This report is the result of an attempt to see what impurity levels and defect levels were present in liquid phase epitaxy GaInAsP epilayers grown on InP substrates. Hopefully, the material contained herein will aid the Air Force Avionics Laboratory in their search for GaInAsP samples sufficiently pure, perfect, and thin (0.4 micrometers) to use in the construction of improved microwave devices. GRA

N79-22941# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DAMAGE STUDIES OF ION-IMPLANTED GaAs USING CONDUCTIVITY PROFILES M.S. Thesis
Russell M. Solt Dec. 1978 67 p
(AD-A064067; AFIT/GE/EE/78D-43) Avail: NTIS HC A04/MF A01 CSCL 20/12

The understanding of damage produced during ion-implantation is an important first step towards predicting the semiconducting behavior of GaAs samples. A new technique for measuring damage has been developed by the Air Force Avionics Laboratory. This method involves the measurement of a differential electrical conductivity profile. Samples of GaAs doped with S(-), Te(-) and Ar(-) ions were prepared for the purpose of profiling them with this technique. GRA

N79-22942# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
LASER ANNEALING OF ION IMPLANTED GALLIUM ARSENIDE M.S. Thesis
Robert S. Mason Dec. 1978 69 p refs
(AD-A063961; AFIT/GEO/PH/78D-3) Avail: NTIS HC A04/MF A01 CSCL 20/12

Ion implanted GaAs, irradiated by a Q-switched ruby laser, is examined primarily by cathodoluminescence, as well as ellipsometry and electrical measurements, to evaluate the quality of laser anneal. Weak cathodoluminescence spectra from laser irradiated samples indicate far less radiative centers than in thermally annealed samples. Emitted radiation from existing centers is attenuated by the formation of a surface layer on GaAs during exposure to the ruby laser, resulting in spectra which is slightly weaker than spectra representative of the material's condition. This attenuating layer occurs in both virgin and implanted GaAs exposed to ruby laser radiation. Ion implanted Si, exposed to the same Q-switched ruby laser, is examined by Rutherford backscattering and indicates a return to crystallinity of the implant layer. Author (GRA)

N79-22943# Varian Associates, Palo Alto, Calif.
NONCOPLANAR HIGH POWER FET Annual Report, Jan. - Dec. 1978
S. G. Bandy, R. Sankaran, S. B. Hyder, and D.M. Collins 27 Oct. 1978 49 p
(Contract N00014-75-C-0303)
(AD-A063956; AR-2) Avail: NTIS HC A03/MF A01 CSCL 09/1

The use of low-doped tubs under the source and drain have significantly reduced the parasitic capacitances of a common-gate noncoplanar power FET structure. Submicron gate lengths were easily achieved with an etch and growth technique.
Author (GRA)

N79-22944# Texas Univ. at Austin. Dept. of Chemistry.
THE MOLECULAR STRUCTURE OF BIS (DIMETHYLAMINO) DIFLUOROSULFURANE: THE FIRST X-RAY CRYSTAL STRUCTURE OF A FLUOROSULFURANCE
P. E. Riley, J. S. Szobota, and M. L. Walker Dec. 1978 40 p refs
(Contract N00014-76-C-0577)
(AD-A063955; TR-78-03) Avail: NTIS HC A03/MF A01 CSCL 07/3

The molecular structure of (Me2N)2SF2 has been determined by single crystal X-ray diffraction methods. The compound crystallizes in the monoclinic system, space group C2/c, with a = 11.00 (2) A, b = 5.693 (6) A, c = 12.24 (3) A, beta = 92.79 (10) deg., and Z = 4. The symmetry of (Me2N)2SF2 is C2, and the structure is essentially trigonal bipyramidal with the fluorine and Me2N ligands occupying axial and equatorial sites, respectively. The third equatorial site is occupied by the sulfur 'lone pair' which lies along the C2 symmetry axis. Since the dihedral angle between the C-N-C and N-S-N planes is 48.2 deg., the nitrogen lone pairs are disposed approximately midway between the sulfur lone pair and the sulfur-fluorine axial (S-F2) bonds. The sum of the bond angles around the nitrogen atoms is 342.3 deg.; hence the hybridization at these centers is approximately halfway between sp(2) and sp(3). The Fa-S-Fa bonds are bent toward the sulfur lone pair by 5.3 deg., and the equatorial N-S-N bond angle is 102.3(1) deg. The S-F and S-N bond distances are 1.770(2) A and 1.648(2) A, respectively. Author (GRA)

N79-22945# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DEPTH-RESOLVED CATHODOLUMINESCENE OF CARBON IMPLANTED GALLIUM ARSENIDE M.S. Thesis
Luciano V. Parzianello Dec. 1978 66 p refs
(AD-A064753; AFIT/GEP/PH/78D-9) Avail: NTIS HC A04/MF A01 CSCL 20/12

Three samples of VPE GaAs grown on SI Cr compensated substrate were examined by depth resolved cathodoluminescence using electrom beam energies from 2.5 KeV to 15 KeV at 10 K and 39 K. The samples had been carbon-implanted, at a 120 KeV implant energy, with fluences of 10 to the 13th power, 10 to the 14th power and 10 to the 15th power carbon ions/sq cm, respectively. The resulting cathodoluminescent spectra contained eight energy peaks: an unresolved exciton peak at 1.514 eV, a conduction band-to-carbon acceptor peak at 1.494 eV, a carbon donor-to-carbon acceptor peak at 1.490 eV, a possible carbon-donor-to-zinc acceptor peak at 1.487 eV, two optical phonon peaks at 1.457 eV and 1.454 eV, an unresolved As vacancy complex at 1.408 eV, and, finally, an unresolved Ga vacancy complex. An attempt was made to observe impurity concentration dependent energy peak shifts, of the conduction band-to-carbon acceptor and the carbon donor-to-carbon acceptor energy peaks, which had been reported for carbon implanted bulk-grown GaAs and attributed to carbon impurity banding. The failure to observe energy peak shifts in the higher-purity VPE GaAs indicates that a more probable explanation for the peak shifts observed in the bulk-grown GaAs involves the use of a tunneling-assisted transition model. GRA

N79-22946# University of Southern California, Los Angeles. Electronic Sciences Lab.
EVALUATION OF GALLIUM NITRIDE FOR ACTIVE MICROWAVE DEVICES Annual Technical Report, Aug. 1977 - Sep. 1978
M. Gershenzon Sep. 1978 83 p refs
(Contract N00014-75-C-0295; RR021203)
(AD-A064299) Avail: NTIS HC A05/MF A01 CSCL 20/12

Thick GaN crystals can now be grown (by the non-equilibrium CVD reaction of GaCl and NH3) that are free of the precipitates, voids and microcracks that plagued us last year. However, they are still dominated electrically by a native shallow donor effect. A high pressure-high temperature system for annealing crystals and for growing crystals by liquid phase epitaxy under high pressure N2 instead of NH3 has been assembled and calibrated, and the first experiments begun to eliminate the native donor, so as to prepare samples suitable for high field electrical measurements. GRA

N79-22947# Naval Surface Weapons Center, White Oak, Md.
PERMEABILITY, MAGNETOMECHANICAL COUPLING AND MAGNETOSTRICTION IN GRAIN-ORIENTED RARE EARTH-IRON ALLOYS
H. T. Savage, R. Abbundi, and A. E. Clark 1 Nov. 1978 18 p refs
(AD-A064671; NSWC/WOL/TR-78-197) Avail: NTIS HC A02/MF A01 CSCL 20/3

Grain-oriented samples of highly magnetostrictive rare earth-iron compounds have successfully been prepared. These samples possess lower inhomogeneous strains than found in the random polycrystalline RFe2 compounds, resulting in much higher values of relative permeability (mu sub r) and magnetomechanical coupling (k(33)). A partially oriented Tb (20Dy(22)ho(.58) Fe(1.95) sample was prepared using a pyrolytic Bridgman type boron nitride crucible. At a bias field of 100 Oe k(33) = .73, which is considerably larger than found in the random polycrystal of the same composition. A relative permeability of 36 occurs in this same sample when a low ac drive of 1.6 Oe rms is used. A second fabrication method using a horizontal zone technique with a supporting 'cold finger' was employed to grow the ternary Tb(27)Dy(.73)Fe(1.98). The low ac drive values of k(33) and Mu sub r were .74 and 19 respectively. The permeability at low bias was found to possess a sharp ac drive dependence. Near zero bias, when the drive was changed from 1.6 Oe rms to 13 Oe rms, mu sub r in the quaternary increased from 36 to 98. In the ternary the values of mu sub r near zero bias increased from 19 to 61. Magnetostriction measurements on both samples show a significant increase in d lambda and gamma s over the random Polycrystals. Author (GRA)

N79-22948# Pennsylvania State Univ., University Park. Materials Research Lab.
TARGETED BASIC STUDIES OF FERROELECTRIC AND FERROELASTIC MATERIALS FOR DIEZOELECTRIC TRANSDUCER APPLICATIONS Technical Report, 1 Jan. - 31 Dec. 1978
L. E. Cross, R. E. Newnham, G. R. Barsch, and J. V. Biggers 31 Dec. 1978 72 p refs
(Contract N00014-78-C-0291)
(AD-A064488) Avail: NTIS HC A04/MF A01 CSCL 20/3

This report documents work initiated during the first nine months of a major new five-year program which is focused on some of the fundamental problems in ferroelectric and ferroelastic crystals which are of special relevance to the design and development of new and improved materials for electromechanical transducers. Electrostriction is the basic coupling mechanism between dielectric and mechanical properties in all present ceramic piezoelectric transducers, yet there is no adequate theoretical description of this phenomenon, and reliable experimental values are not available for the electrostriction constants of many simple insulators. For experimental measurement of electrostrictive deformations an ultrasensitive AC dilatometer is being developed. The present instrument will resolve displacements of 0.005A at 7.5 Hz, and is presently being used to measure electrostriction constants for a range of alkali halide crystals. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N79-22949 Wisconsin Univ. - Madison.
SOLITONS AND BREATHERS IN SINE-GORDON FIELD THEORY Ph.D. Thesis
Yoo-Bang Chon 1978 89 p
Avail: Univ. Microfilms Order No. 7823725

Using Lamb's diagrammatic technique the most general Backlung transform solution of the sine-Gordon equation was obtained. The collision between a soliton and a breather results in a shift in their positions (spatial shift). Despite this, it is shown that there is no net force between them; periodic solutions exist in which they have zero relative velocity (aggregates). The construction of the sine-Gordon fluctuation vacuum as a coherent state was attempted. The superselection rule between different soliton sectors is discussed. Dissert. Abstr.

N79-22950 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE THERMODYNAMIC PERFORMANCE OF TWO COMBINED CYCLE POWER PLANTS INTEGRATED WITH TWO COAL GASIFICATION SYSTEMS Ph.D. Thesis
Francis Lee Stasa 1978 408 p
Avail: Univ. Microfilms Order No. 7904883

Thermodynamic models of both an adiabatic and an endothermic coal gasifier integrated with either a waste heat combined cycle or a supercharged boiler combined cycle are developed and incorporated into a FORTRAN computer program. Certain components are added to each configuration in an effort to improve thermodynamic performance, with the effect of each clearly noted. With consideration of the criteria, the station efficiencies for each configuration are within 1 percentage point of each other when flue gas recirculation is used as a means to control the amount of nitric oxide which enters the atmosphere. With a gas turbine inlet temperature of 2000 F and with consideration of the pollution criteria, the configuration employing an adiabatic gasifier and a waste heat system is marginally the best with a station efficiency of only 37 percent. Dissert. Abstr.

N79-22951# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
HOLE STATISTICS IN DENSE RANDOM PACKING Interim Report
H. J. Frost Dec. 1978 61 p
(Contract N00014-77-C-0002; NR Proj. 038-138)
(AD-A064704; TR-6) Avail: NTIS HC A04/MF A01 CSCL 20/13

The structure of dense random packings of hard spheres has been investigated in terms of the polyhedral holes between the spheres, using both all triangular-faced polyhedra called deltahedra, and local arrangements allowing three- and four-edged faces. Two models were analyzed: The mechanical model of Finney, and the computer-generated model of Bennett. The number and sizes of the sites for small interstitial spheres were also calculated for both models. The structural units described and the results may be applicable to the structure of liquid metals and metallic glasses. Author (GRA)

N79-22952# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Studies.
THE SECOND LAW OF THERMODYNAMICS AND STABILITY
C. M. Dafermos Dec. 1978 25 p refs
(Contract N00014-76-C-0278; Grants DAAG27-76-G-029; NSF MCS-76-07247)
(AD-A064091) Avail: NTIS HC A02/MF A01 CSCL 20/13

There are several indications pointing to an intimate relationship between the second law of thermodynamics and 'stability'. An attempt is made to establish a different connection between stability and the second law, in that 'stability' will be interpreted as continuous dependence of thermodynamic

processes upon initial state and supply terms. The ideas will be presented within the context of thermoelasticity theory, without heat conduction. The hyperbolic character of the field equations causes the breakdown of smooth solutions and the development of shock waves so the class of smooth functions is far too narrow to encompass all processes of physical interest. The natural framework is the class of proper processes, characterized by the property that velocity, deformation gradient, specific entropy, stress, temperature and internal energy are functions of bounded variation. GRA

N79-22953# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN INVESTIGATION OF THE METHOD OF FINITE ELEMENTS WITH ACCURACY COMPARISONS TO THE METHOD OF FINITE DIFFERENCES FOR SOLUTION OF THE TRANSIENT HEAT CONDUCTION EQUATION USING OPTIMUM IMPLICIT FORMULATIONS M.S. Thesis

Joseph C. Geneczko Dec. 1978 179 p refs
(AD-A063962; AFIT/GNE/PH/78D-15) Avail: NTIS HC A09/MF A01 CSCL 20/13

The one-dimensional transient heat conduction equation, with Dirichlet boundary conditions, is solved by the method of finite-elements, employing a quadratic interpolation function. The numerical solutions are investigated with respect to accuracy and stability, and compared to like results attained by the method of finite-differences, and the finite-element method with linear interpolation. The version of the finite-element method used was based on a variational principle which is stationary in time; the temporal behavior of the differential equation is treated with a finite-difference approximation. This method is equivalent to the method of Galerkin, called the Method of Weighted Residuals. The inherent discontinuity between the initial condition and boundary conditions was accounted for by substituting the exact analytical solution at the first time step and numerically computating from there. An equivalency relationship between the two finite-element methods is shown to exist. The finite-difference version of the Crank-Nicolson method is found to be more accurate than the finite-element version; for the fully implicit method, the opposite is found to be true. In the optimum implicit method, both finite-element solutions are shown equivalent to the finite-difference solution for a Fourier modulus of one. For other values of this parameter, the finite-element solution is more accurate. Author (GRA)

N79-22954# IRT Corp., San Diego, Calif.

BEAM STUDIES OF MOLECULAR PROCESSES ON METAL SURFACES

Robert L. Palme Jan. 1979 15 p refs
(Contract N00014-77-C-0255)
(AD-A064114; IRT-8162-001; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07/4

The isosteric heats of adsorption of NO and O2 have been studied on epitaxially grown Pt(111) using elastic helium scattering as the surface coverage probe. The measured isosteric heats for No and O2 are 21 and 26 kcal/mole, respectively. The data also indicate a pre-exponential factor for NO desorption of less than 2 x 10 to the 7th power. GRA

N79-22955# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

INVESTIGATION OF ACCELERATING THE FINITE ELEMENT SOLUTION OF THE TWO DIMENSIONAL STEADY STATE HEAT TRANSFER EQUATION M.S. Thesis

Frederick J. Jaeger Dec. 1978 97 p refs
(AD-A064417; AFIT/GNE/PH/78D-6) Avail: NTIS HC A05/MF A01 CSCL 20/13

The relative solution time is studied for two methods of accelerating successive overrelaxation. Reordering of equations by nodal point scanning, and coarse mesh rebalancing are used. The finite element solution of the steady-state two-dimensional heat transfer equation is used to test these methods. Scanning the boundary nodal points first was found to reduce the number of iterations necessary for convergence by up to 13%, but computer execution was increased by up to 7%. Coarse mesh rebalancing was found to speed the solution with arbitrary successive overrelaxation factor by reducing the number of iterations to 15% of that without rebalancing. The computer execution time required for a well chosen coarse mesh was only reduced to 30% of that without rebalancing. The successive overrelaxation factor was found to influence the optimum rebalancing frequency. Solutions as fast as the solution with the optimum overrelaxation factor were obtained with rebalancing and arbitrary overrelaxation factors. Rules for a proper coarse mesh and rebalancing frequency are given. Author (GRA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-22956# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.

RESOURCE MANAGEMENT IN LARGE SYSTEMS Ph.D. Thesis

Rajan Suri Dec. 1978 208 p refs
(Contract N00014-75-C-0648; Grant NSF ENG-76-11824)
(AD-A064780; TR-671) Avail: NTIS HC A10/MF A01 CSCL 05/1

This work studies the application of decentralization to the problem of Resource Management in Large Systems. In an operational system, where a very large number of activities share limited resources, this Resource Management problem has three objectives. The first ('Initial Allocation') is to find an assignment of resources to every activity, such that all the system constraints are satisfied, and all activities are operating. The second ('New-Assignment') is to find a rationale for allocating resources to new activities. New activities are initiated frequently enough that it is not desired to re-solve the entire problem for the combined set of old and new activities. The third objective ('Periodic Review') is to find an efficient way of re-allocating resources in order to reflect the changing needs of the individual activities, as well as the changes in total resource usages. Conventionally, the resource-allocation problem has been studied for the case where, in addition to the constraints, there exists an objective to be maximized. The emphasis, as is reflected by the title of this work, is on the feasibility aspect of the problem, that is, of taking a large system and keeping it operational. It is shown that this in itself is both an important problem, and has theoretically interesting consequences. In addition, the results can be useful for the solution of the general (optimization) problem. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N79-22957* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AMES RESEARCH CENTER PUBLICATIONS, 1977

Apr. 1979 123 p
(NASA-TM-78514; A-7704) Avail: NTIS HC A06/MF A01 CSCL 05B

This bibliography lists 786 formal NASA publications, journal articles, books, chapters of books, patents, and contractor reports which appeared during 1977 or which were not included in

previous annual bibliographies. Citations are arranged by directorate, type of publication, and author. Each NASA report is identified by a technical report and accession number to facilitate ordering. An author index is provided. A.R.H.

N79-22958* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY, 1978
1 Apr. 1979 187 p
(Contract NAS7-100)
(NASA-CR-158493; JPL-Bibl-39-20) Avail: NTIS HC A09/MF A01 CSCL 05B

This bibliography cites 958 externally distributed technical papers released during calendar year 1978, that resulted from scientific and engineering work performed, or managed, by the Jet Propulsion Laboratory. The publications are indexed by author, subject, publication type and number. A descriptive entry appears under the name of each author of each publication; an abstract is included with the entry for the primary (first-listed) author. A.R.H.

N79-22959 Missouri Univ. - Columbia.
ANALYSIS OF VARIOUS DIRECT ACCESS DEVICE FILE SYSTEM STRUCTURES Ph.D. Thesis
Paul Woo Joong Youn 1978 619 p
Avail: Univ. Microfilms Order No. 7906946

Using digital simulation techniques, three file systems structures, indexed sequential, indexed random and random, are investigated. The performance of a file management system incorporating these structures and implemented using a rotating magnetic disk as a secondary storage is investigated by simulating the process of building a file. The role of the load factor in performance degradation is examined. The results of the investagation concerning the indexed sequential file system are explained in terms of the increased disk activity and processing complexity required when data records must be stored or retrieved from overflow storage. The effects of two design parameters, the location of the index and the location of the independent overflow area, are determined and discussed. Dissert. Abstr.

N79-22960*# National Aeronautics and Space Administration, Washington, D. C.
TECHNICAL PUBLICATIONS PROGRAM. A WORKING GUIDE
1979 18 p
(NASA-TM-80412) Avail: NTIS HC A02/MF A01 CSCL 05B

Many of the questions that arise during the day-to-day activities of NASA's agency-wide scientific and technical publication program are answered. This document provides information on the policies and procedures of the program. In addition to serving as a guide for NASA Headquarters and NASA field installation personnel, this publication may be referenced in NASA contract and grant instruments. L.S.

N79-22961# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
RESEARCH IN INFORMATION PROCESSING Final Report, 1 Jul. 1976 - 30 Jun. 1978
Allen Newell and Joseph F. Traub Dec. 1978 120 p refs
(Contract F44620-73-C0074; ARPA Order 2466)
(AD-A064845; AFOSR-79-0043TR) Avail: NTIS HC A06/MF A01 CSCL 09/2

The report is organized as five chapters under five major areas of research: Image Understanding systems, Speech Understanding systems, Machine Intelligence, Software Technology, and Multiprocessors. Each chapter is self-contained and can be read without reading the entire report. GRA

N79-22962# CTEC, Inc., Falls Church, Va.
ALERT CAPABILITY SUPPORT
Oct. 1978 52 p refs
(Contract N00014-77-C-0551)
(AD-A064104; CTEC-7810022) Avail: NTIS HC A04/MF A01 CSCL 05/2

Examines the existing distributed data base file allocation models and gives a breakdown of the models by type (deterministic one-phase, deterministic multi-phase, stochastic discrete, stochastic continuous). The relationships and identities used to describe the models are divided into four categories: file information and parameters, transmission characteristics, computer characteristics, and costs. In the investigations which led to this paper it was seen that the means defined were initially very general. The models included relationships which were very detailed in their description of the file allocation problem. In previous analyses using these models, simplifications were often made for computational tractability. Many of the assumptions and models ended up so restricted in scope or detail as to be unrealistic. There is a great need for more work in this area. Author (GRA)

N79-22963# Bureau of Mines, Reno, Nev. Metallurgy Research Center.
CORES OPERATIONS MANUAL: BUREAU OF MINES CORE REPOSITORY SYSTEM
1978 126 p refs
(PB-289854/2; BM-IC-8784) Avail: NTIS HC A07/MF A01 CSCL 08G

The new Bureau of Mines Core Repository System (CORES) is described and the methods for selecting, processing, and storing physical samples and descriptive data for future reference by earth scientists are presented. The system preserves splits of chip samples and longitudinally sliced segments of core. A records retrieval system provides for storage data on microfilm and magnetic tapes and uses the keysort parameters of location and commodity for the identification of data. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N79-22964# RAND Corp., Santa Monica, Calif.
AN APPRAISAL OF MODELS USED IN LIFE CYCLE COST ESTIMATION FOR USAF AIRCRAFT SYSTEMS Interim Report
Kenneth E. Marks, H. Garrison Massey, and Brent D. Bradley Oct. 1978 128 p
(Contract F49620-77-C-0023)
(AD-A064333; RAND/R-2287-AF) Avail: NTIS HC A07/MF A01 CSCL 14/1

Although life cycle analysis is widely used as a management tool, considerable uncertainty still exists about its effectiveness with respect to economic tradeoffs, funding decisions, and resource allocations. This report evaluates some of the most widely used life cycle cost (LCC) models: AFR 173-10 models (BACE AND CACE); the Logistics Support Cost Model; the Logistics Composite model; the MOD-METRIC model; AFM 26-3 Manpower Standards; Air Force Logistics Command Depot Maintenance Cost Equations; the DAPCA model; and the PRICE model. The models are rated within a framework incorporating a set of life cycle cost elements and a set of cost driving factors. Color-coded illustrations summarize the results. The models are shown to have many shortcomings that limit their usefulness for life cycle analyses in which estimates of absolute, incremental cost are required. Specific areas are identified where driving factor/cost element combinations are not adequately addressed. Author (GRA)

N79-22965# Transportation and Economic Research Associates, Inc., Arlington, Va.
REPORT ON CAPITAL REQUIREMENTS FOR TRANSPORTATION OF ENERGY MATERIALS
9 Jun. 1978 263 p refs
(Contract DOE-CR-03-70307-00)
(TID-28599) Avail: NTIS HC A12/MF A01

Sufficient data was obtained and organized so that costs of expanding capacity in transportation of energy materials can be determined in a way designed to meet the needs and requirements of the Project Independence Evaluation System (PIES) model. Requirements for capital expenditures are computed for three modes of transport in five computer-based algorithms: oil pipeline investment; gas pipeline investment; rail car and locomotive investment; coal barge and collier investment; and oil barge

and tanker investment. Necessary data and assumptions are organized within the context of each algorithm either as a separate data base or written into the program as suits the nature of the mode and the output information obtainable from PIES. DOE

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N79-22966# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
INDUSTRIAL WASTE TREATMENT USING ADSORPTION-OXIDATION PROCESS Final Report
K. K. Jain 7 Dec. 1978 59 p refs
(Contract DAAK70-77-C-0303)
(AD-A063490; Doc-78SDR2366) Avail: NTIS
HC A04/MF A01 CSCL 13/2

The objective of this study was to demonstrate the application of the adsorption-oxidation (A/O) process to the treatment of industrial wastes. The A/O process is a novel, proprietary process currently being developed by the Re-entry and Environmental Systems Division (RESD) of the General Electric Company. It is designed to remove dissolved organics from wastewater. The process concept is based on removing the organics by adsorption on a suitable adsorbent and regenerating the adsorbent in-situ simultaneously by using a chemical oxidant. The oxidation scheme may include the use of catalysts, UV radiation, or ultrasonic energy to enhance the oxidation reaction. GRA

N79-22967# Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
FIXATION OF TOBYHANNA ARMY DEPOT ELECTROPLATING WASTE SAMPLES BY ASPHALT ENCAPSULATION PROCESS Final Report, Oct. 1977 - Oct. 1978
Alan B. Rosencrance and Ramchandra K. Kulkarni Jan. 1979 27 p refs
(DA Proj. 3E1-62720-A-835)
(AD-A064712; USAMBRDL-TR-7902) Avail: NTIS
HC A03/MF A01 CSCL 13/2

Electroplating waste samples from Tobyhanna Army Depot, PA, and other synthetically prepared samples of hazardous waste were fixed by the WPC-VRS process of Werner and Pfleiderer Corp. (asphalt micro-encapsulation) and evaluated by using the modified Wisconsin leaching test. It was found that the process provides satisfactory attenuation to leaching of heavy metal ions, hexavalent chromium, and cyanide. The presence of complexing ions like cyanide, ammonia, and high pH, however, seems to adversely affect the performance of the process, slightly increasing the leaching of zinc, copper and cadmium. Excepting these metals, the concentrations of other metals in the leachates generated are within the limits set by the proposed Pennsylvania State Regulations and/or USEPA Standards. Author (GRA)

N79-22968# Tetra Tech, Inc., Lafayette, Calif.
RATES, CONSTANTS, AND KINETICS FORMULATIONS IN SURFACE WATER QUALITY MODELING Final Report, May 1976 - Nov. 1978
Stanley W. Zison, William B. Mills, Dennis Deimer, and Carl W. Chen Dec. 1978 338 p refs
(Grant EPA-R-804450-01-2)
(PB-290938/0; EPA-600/3-78-105) Avail: NTIS
HC A15/MF A01 CSCL 13B

Studies are reviewed to provide a comprehensive volume on state-of-the-art formulations used in surface water quality modeling along with accepted values for rate constants and coefficients. Topics covered include system geometric representation (spatial and temporal), physical processes (mass transport, heat budgets, ice formation, light extinction), biological systems (fish, benthic organisms), and chemical processes (nutrient cycles, carbonate system). A detailed discussion is also presented on issues that are ordinarily of primary interest in modeling studies. These include reaeration, dissolved oxygen saturation, photosynthesis, deoxygenation, benthic oxygen demand, coliform bacteria, algae, and zooplankton. These discussions incorporate factors affecting the specific phenomena and methods of measurement in addition to data on rate constants. GRA

N79-22969# Urbitran Associates, Inc., N. Y.
REVIEW OF LOCAL ALTERNATIVES ANALYSES INVOLVING AUTOMATED GUIDEWAY TRANSIT (AGT) Final Report
R. B. Lee Feb. 1978 101 p refs
(Contract DOT-UT-70049)
(PB-291334/1; UMTA-NY-06-0057-78-1) Avail: NTIS
HC A06/MF A01 CSCL 13B

The attributes of Automated Guideway Transit (AGT) vis-a-vis conventional urban transportation alternatives were studied in order to determine whether a need for AGT systems (1) exists within U.S. urban areas, (2) define the locally perceived role of AGT, (3) determine the impediments to its adoption, and (4) identify needed improvements to current and future generations of AGT systems. The findings of the report include: (1) Most of the critical issues in the transportation decision-making process are not AGT-specific. They include costs (capital and O and M), overhead structures, Federal and local funding, technical risk, and public and political support. (2) There is a wide variation in perceptions of the role of AGT, impediments to its adoption, and needed improvements. (3) Major problem areas are of a nontechnical nature. GRA

N79-22970# Ender (Richard L.), Anchorage, Alaska.
ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM. BEAUFORT SEA PETROLEUM DEVELOPMENT SCENARIOS: IMPACTS ON ANCHORAGE, ALASKA
Richard L. Ender, Jan Gehler, Susan Gorski, and Susan Harper Aug. 1978 233 p refs Prepared for Peat, Marwick, Mitchell and Co., Anchorage, Alaska 3 Vol.
(Contract DI-AA550-CT6-61)
(PB-291916/5; BLS/YK/TR-78/13; TR-13) Avail: NTIS
HC A11/MF A01 CSCL 10A

An impact assessment on the Municipality of Anchorage is presented which encompasses socioeconomic and physical data, as it relates to future population growth and the overriding ramifications of four proposed development scenarios in the Beaufort Sea region. Services are briefly described and, where applicable, quantitative and/or qualitative standards are offered to assess impact. Results of analysis within the community sector include examination of education, public safety, leisure, utilities, housing, health services, social services, transportation, and fiscal requirements. GRA

N79-22971# Dooley (Dennis) and Associates, Anchorage, Alaska.
ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM. BEAUFORT SEA PETROLEUM DEVELOPMENT SCENARIOS: TRANSPORTATION IMPACTS
Peter Eakland and Dennis Dooley Aug. 1978 175 p refs Prepared for Peat, Marwick, Mitchell and Co., Anchorage, Alaska 3 Vol.
(Contract DI-AA550-CT6-61)
(PB-291917/3; BLM/YK/TR-78/20; TR-20) Avail: NTIS
HC A08/MF A01 CSCL 10A

The statewide, regional and local transportation impacts of Beaufort Sea petroleum exploration, development, and production are analyzed. Alternative routings for goods and passengers to the area are developed for each mode. Facilities on these routes and carriers using them are described for current conditions. Impacts related to non-OCS (Outer Continental Shelf) develop-

ment up to the year 2000 are estimated. Individual assessments are given for the petroleum development scenarios for Camden-Canning, Prudhoe Bay-Small, Cape Halkett, and Prudhoe Bay-Large. GRA

N79-22972# Worl Associates, Anchorage, Alaska.
ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM. ASSESSMENT OF CHANGE IN THE NORTH SLOPE, BEAUFORT SEA REGION SOCIOCULTURAL SYSTEMS
Apr. 1978 115 p refs Prepared for Peat, Marwick, Mitchell and Co., Anchorage, Alaska 3 Vol.
(Contract DI-AA550-CT6-61)
(PB-291918/1; BLM/YK/TR-78/22; TR-22) Avail: NTIS HC A06/MF A01 CSCL 10A

The Beaufort Sea Region sociocultural systems, are currently undergoing rapid and intense social, cultural, and economic change. The overall effects on traditional values and sociocultural systems are assessed to determine whether the Inupiat can integrate modernizing influences without disrupting their unique sociocultural system. GRA

N79-22973# Alabama Univ. in Birmingham. Dept. of Biology.
VIABILITY MEASUREMENTS ON ACTIVATED SLUDGE M.S. Thesis
James Edward Russell 1978 97 p refs Sponsored by DI
(PB-290805/1; W79-04006; OWRT-A-060-ALAB(2)) Avail: NTIS HC A05/MF A01 CSCL 13B

A study to determine cell viability in industrial and municipal sludges is reported. Viability measurements incorporated into routine monitoring of an industrial activated sludge plant included: (1) fluorescence microscopy; (2) viable plate counts; (3) assay of Adenosine triphosphates (ATP) levels; and (4) endrogenous and substrate stimulated oxygen consumption. The standard monitoring techniques used include mixed liquor suspended solids (MLSS) and mixed liquor volatile suspended solids (MLVSS). All measurements were correlated with effluent water quality. GRA

N79-22974# Bureau of Mines, College Park, Md. Avondale Metallurgy Research Center.
SOURCES OF METALS IN THE COMBUSTIBLE FRACTION OF MUNICIPAL SOLID WASTE
Benjamin W. Haynes, Stephen L. Law, and William J. Campbell 1978 22 p refs
(PB-289863/3; BM-RI-8319) Avail: NTIS HC A02/MF A01 CSCL 13B

The Bureau of Mines conducted research to devise technology for increasing the Nation's mineral supply by recovering valuable constituents from currently discarded waste materials. Muncipal solid waste (MSW), presently a major disposal problem, represents a significant source of metals, glass, and a combustible fraction that can be used to supplement coal in generalizing heat and electricity. As part of the total metallurgical system to treat MSW, this study evaluates the combustible fraction of MSW to characterize the various combustible components and to identify the principal sources of elements that eventually may be objectionable from corrosive or environmental considerations. GRA

N79-22975# Massachusetts Univ., Amherst. Water Resources Research Center.
BIOLOGICAL NUTRIFICATION AND DENITRIFICATION USING ROTATING BIOLOGICAL CONTRACTORS
James C. OShaughnessy, Frederic C. Blanc, Peter Brooks, Daniel Connick, and Alan Silbovitz Jul. 1978 114 p refs Prepared in cooperation with Northeastern Univ., Boston, Mass.
(Contract DI-14-24-0001-7046)
(PB-291724/3; Pub-97; W79-03383; OWRT-A-085-MASS(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

The ability of Rotating Biological Contactors (RBC) to provide biological nitrification and denitrification of secondary treated domestic wastewater was evaluated. The study involved both bench scale and pilot scale testing. The results indicated that the ammonia nitrogen application rate and volume to surface ratio of the unit are major design parameters to achieve proper nitrification with RBC units. Ninety four percent ammonia conversion was observed for an ammonia loading rate of 0.20 lbs. NH3-N/1 1000 sq ft/day. In order to achieve a high degree of nitrification, a minimum of two stages should be used in RBC unit design, and supplemental alkalinity addition may be required. The dentrification study indicated that RBC units can be used to achieved biological dentrification of domestic wastewater. GRA

N79-22976# North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
RESEARCH NEEDS IN COMMUNITY WATER MANAGEMENT FOR THE NATIONAL SCIENCE FOUNDATION
Daniel A. Kun Aug. 1978 125 p Sponsored by NSF
(PB-291607/0; NSF/RA-780373) Avail: NTIS HC A06/MF A01 CSCL 13B

The Community Water Mangement program assists in increasing the Nation's ability to manage community water supply and wastewater disposal in ways that reduce public costs or reduce the risks to public health, safety, and the environment. This report examines critical research needs in the technical, scientific, or managerial components of community water management that are not now receiving sufficient attention. The critical research needs are classified into two categories; research that might be particularly addressed by the National Science Foundation and other research. The second category is where most research funds in community water management are being spent because the bulk of this research is likely to be addressed by the mission-related agencies. GRA

N79-22977# New Hampshire Univ., Durham. Water Resources Research Center.
AEROBIC DIGESTION OF WASTEWATER SLUDGE UNDER LOW TEMPERATURE CONDITIONS
Paul L. Bishop 1978 121 p refs
(Contract DI-14-31-0001-4029)
(PB-291519/7; W79-02911; RR-18; OWRT-A-037-NH(3)) Avail: NTIS HC A06/MF A01 CSCL 13B

The effect of cold temperatures (5 to 30 C) on the aerobic digestion process, and the fate of nutrients (nitrogen and phosphorus) in the sludge during digestion were investigated using primary sludge from two locations and waste activated sludge from two others. Both batch and continuous flow reactors were used. The effect of temperature on digestion operation and digestion kinetics was determined by operating digesters at varying temperatures, detention times and loading rates, and analyzing for both solids and organic destruction. Changes in settleability and filterability of the sludge were also measured. Nutrient transformations during digestion were determined by maintaining a nutrient mass balance during the aerobic digestion process. GRA

N79-22978# Utica Coll., N. Y.
EVALUATION AND COMPARISON OF OVERLAND FLOW AND SLOW RATE SYSTEMS TO UPGRADE SECONDARY WASTEWATER LAGOON EFFLUENT Water Quality Series Report
Michael C. Kemp, Daniel S. Filip, and Dennis B. George Dec. 1978 70 p refs
(Contract DI-14-34-0001-8047)
(PB-291729/8; UWRL-Q-78/02; W79-03007; OWRT-A-034-UTAH(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

To evaluate the effectiveness of overland flow treatment in upgrading secondary wastewater lagoon effluent, three 15 x 36 m plots on a 2.5 percent slope were constructed and sown for a high density vegetative cover using Reed Canary grass. Wastewater was applied to the upper end of each plot at rates of 7.5, 15, and 22.5 cm/week. Results from the overland flow system investigation were compared with similar data obtained the preceding year from an existing slow rate land application system on an adjacent site. Secondary effluent from the same lagoon system was applied to the slow rate system study area. After evaluating influent and effluent water quality characteristics from both systems, site specific efficiencies were detailed. GRA

88 SPACE SCIENCES (GENERAL)

N79-22979*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ALSEP TERMINATION REPORT
James R. Bates, W. W. Lauderdale (General Electric Co.), and Harold Kernaghan (Kentron International, Inc.) Apr. 1979 161 p refs
(NASA-RP-1036; S-480) Avail: NTIS HC A08/MF A01 CSCL 03B

The Apollo Lunar Surface Experiments Package (ALSEP) final report was prepared when support operations were terminated September 30, 1977, and NASA discontinued the receiving and processing of scientific data transmitted from equipment deployed on the lunar surface. The ALSEP experiments (Apollo 11 to Apollo 17) are described and pertinent operational history is given for each experiment. The ALSEP data processing and distribution are described together with an extensive discussion on archiving. Engineering closeout tests and results are given, and the status and configuration of the experiments at termination are documented. Significant science findings are summarized by selected investigators. Significant operational data and recommendations are also included. G.Y.

N79-22980*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
MOLECULES OF SIGNIFICANCE IN PLANETARY AERONOMY
Hari Mohan Jan. 1979 318 p refs
(NASA-RP-1030) Avail: NTIS HC A14/MF A01 CSCL 03B

This monograph is basically devoted to spectroscopic information of the molecules of planetary interest. Only those molecules have been dealt with which have been confirmed spectroscopically to be present in the atmosphere of major planets of our solar system and play an important role in the aeronomy of the respective planets. An introduction giving the general conditions of planets and their atmospheres including the gaseous molecules is given. Some typical planetary spectra is presented and supported with a discussion on some basic concepts of optical absorption and molecular parameters that are important to the study of planetary atmospheres. Quantities like dipole moments, transition probabilities, Einstein coefficients and line strengths, radiative life times, absorption cross sections, oscillator strengths, line widths and profiles, equivalent widths, growth curves, bond strengths, electronic transition moments, Franck-Condon factors and r-centroids, etc., are discussed. Spectroscopic information and relevant data of 6 diatomic (HF, HCL, CO, H2, O2, N2) and 6 polyatomic (CO2, N2), O3, HeO, NH3, CH4) molecules are presented. L.S.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-22981*# Princeton Univ. Observatory, N. J.
LARGE AREA CCD IMAGE SENSORS FOR SPACE ASTRONOMY Final Technical Report, 1 Nov. 1977 - 28 Feb. 1979
Martin Schwarzschild 6 Apr. 1979 16 p
(Grant NsG-7379)
(NASA-CR-158478) Avail: NTIS HC A02/MF A01 CSCL 03A

The Defense Advanced Research Projects Agency (DARPA) has a substantial program to develop a 2200 x 2200 pixel CCD (Charge Coupled Device) mosaic array made up of 400 individual CCD's, 110 x 110 pixels square. This type of image sensor appeared to have application in space and ground-based astronomy. Under this grant a CCD television camera system was built which was capable of operating an array of 4 CCD's to explore the suitability of the CCD's to explore the suitability of the CCD for astronomical applications. Two individual packaged CCD's were received and evaluated. Evaluation of the basic characteristics of the best individual chips was encouraging, but the manufacturer found that their yield in manufacturing this design is two low to supply sufficient CDD's for the DARPA mosaic array. The potential utility of large mosaic arrays in astronomy is still substantial and continued monitoring of the manufacturers progress in the coming year is recommended. G.Y.

N79-22982# Xerox Electro-Optical Systems, Pasadena, Calif. Vista Lab.
PLANETARY EPHEMERIS PROGRAM FOR HP 67/97 CALCULATOR
G. R. Greenfield 2 Mar. 1979 13 p
(Proj. DUB/Galaxy)
(Rept-01-79) Avail: NTIS HC A02/MF A01

A description is given of a calculator program and its use in determining the ephemeris of the nine planets in heliocentric space. The program is written for a hand-held Hewlett Packard Model 67 (or 97) calculator but could be adapted to other comparable calculators. The program enables the analyst to quickly determine the heliocentric longitude (the two-dimensional program assumes all planets lie in the plane of the ecliptic), velocity, radius from the Sun, and flight path angle for any of the nine planets for the period from 1 January 1960 to 31 December 2059. Accuracies within approximately 0.3 degree in longitude exist for all planets except Pluto. Pluto has a large orbital inclination, and this results in errors of as much as 1.3 degrees between 1960 and 1990. L.S.

N79-22983# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ROTATING BODIES AND THEIR LIGHT CURVES
Laurence G. Taff Nov. 1978 17 p
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A063502; TN-1978-37; ESD-TR-78-280) Avail: NTIS HC A02/MF A01 CSCL 03/1

This report discusses the theoretical impossibility of deducing the surface reflectivity of a rotating illuminated body from its lightcurve. First the lightcurve for an arbitrary convex body as an expansion in spherical harmonics is derived. From the form of the resulting lightcurve and its Fourier series the negative result follows immediately. Author (GRA)

N79-22984# Naval Research Lab., Washington, D. C. Space Sciences Div.
COMPRESSION OF EPHEMERIDES BY DISCRETE CHEBYSHEV APPROXIMATIONS Final Report
Andre Deprit (Cincinnati Univ.), Henry Pickard, and Walter Poplarchek (Cincinnati Univ.) Jan. 1979 23 p refs
(RR0140241)
(AD-A063376; NRL-8380) Avail: NTIS HC A02/MF A01 CSCL 03/3

Polynomial representations of astronomical ephemerides are usually derived from discrete least-squares approximations. Ideally, to ensure a uniform distribution of the error, one should aim at a continuous Chebyshev approximation. This is feasible when the ephemeris is generated from a literal (analytical or semianalytical) development. But a discrete Chebyshev approximation is a realistic compromise. Application to the moon and geosynchronous satellites has given good results. On the whole, long ranges (several times the sidereal period) may be covered by polynomials of degree 30 to 50 with a moderate error. A low-degree approximation over half the period usually delivers a high accuracy. Gibbs' phenomena, i.e. rapid oscillations of increasing amplitudes in the error curve at both ends of the approximation interval, are of course absent, contrary to what usually happens in a least-squares approximation. Author (GRA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-22159*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A REEXAMINATION OF THE RADIAL DEPENDENCE OF WEAK INTERPLANETARY SCINTILLATION
A. L. Berman *In its* The Deep Space Network 15 Apr. 1979 p 119-123 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-22985*# Texas Univ., Galveston. Marine Science Inst.
ALSEP DATA PROCESSING: HOW WE PROCESSED APOLLO LUNAR SEISMIC DATA Final Technical Report
Gary V. Latham, Yosio Nakamura, and H. James Dorman 1 Mar. 1979 22 p refs
(Contract NAS9-14810)
(NASA-CR-160141) Avail: NTIS HC A02/MF A01 CSCL 03B

The Apollo lunar seismic station network gathered data continuously at a rate of 3 x 10 to the 8th power bits per day for nearly eight years until the termination in September, 1977. The data were processed and analyzed using a PDP-15 minicomputer. On the average, 1500 long-period seismic events were detected yearly. Automatic event detection and identification schemes proved unsuccessful because of occasional high noise levels and, above all, the risk of overlooking unusual natural events. The processing procedures finally settled on consist of first plotting all the data on a compressed time scale, visually picking events from the plots, transferring event data to separate sets of tapes and performing detailed analyses using the latter. Many problems remain especially for automatically processing extraterrestrial seismic signals. Author

N79-22986*# Martin Marietta Labs., Baltimore, Md.
PETROGRAPHIC AND PETROLOGICAL STUDIES OF LUNAR ROCKS Final Report, Mar. - Dec. 1978
Stephen R. Winzer Dec. 1978 47 p refs
(Contract NAS9-15583)
(NASA-CR-160149; MML-TR-78-57c) Avail: NTIS HC A03/MF A01 CSCL 03B

Thin sections and polished electron probe mounts of Apollo 15 glasscoated breccias 15255, 15286, 15466, and 15505 were examined optically and analyzed by sem/microprobe. Sections from breccias 15465 and 15466 were examined in detail, and chemical and mineralogical analyses of several larger lithic clasts, green glass, and partly crystallized green glass spheres are presented. Area analyses of 33 clasts from the above breccias were also done using the SEM/EDS system. Mineralogical and bulk chemical analyses of clasts from the Apollo 15 glass-coated breccias reveal a diverse set of potential rock types, including plutonic and extrusive igneous rocks and impact melts. Examination of the chemistry of the clasts suggests that many of these clasts, like those found in 61175, are impact melts. Their variability suggests formation by several small local impacts rather than by a large basin-forming event. Author

N79-22987*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
A STUDY OF THE FEASIBILITY OF ULTRAVIOLET SPECTROMETRY FOR COMETARY MISSIONS Final Report
Paul D. Feldman 28 Feb. 1979 69 p refs
(Grant NsG-7382)
(NASA-CR-158492) Avail: NTIS HC A04/MF A01 CSCL 03B

Ultraviolet spectra fo the comet West obtained by sounding rocket experiments in 1976 are reproduced and interpreted in order to estimate the expected brightness of the emission features and determine the spatial extent of these features for the proposed Halley Flyby/Tempel 2 rendezvous and the possible Halley or Encke flybys close to perihelion. A coma model was constructed and evaluated for the physical condition of candidate targets such as heliocentric distance, gas production, and composition. In addition to brightness profiles, the neutral and ion densities of the principal species are also dervied. The brightness profiles can be used to determine the feasibility of utilizing the space telescope to provide supporting observations during the mission. Basic parameters identified are spectral range, wavelength resolution, spatial resolution, sensitivity and dynamic range, rejection of scattered light, and integration or accumulation time. A.R.H.

N79-22988*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INHOMOGENEOUS MODELS OF THE VENUS CLOUDS CONTAINING SULFUR
Sheldon M. Smith, James B. Pollack, Lawrence P. Giver, Jeffrey N. Cuzzi, and Morris Podolak (Tel-Aviv Univ.) Apr. 1979 57 p refs
(NASA-TM-78558; A-7701) Avail: NTIS HC A04/MF A01 CSCL 03B

Based on the suggestion that elemental sulfur is responsible for the yellow color of Venus, calculations are compared at 3.4 microns of the reflectivity phase function of two sulfur containing inhomogeneous cloud models with that of a homogeneous model. Assuming reflectivity observations with 25% or less total error, comparison of the model calculations leads to a minimum detectable mass of sulfur equal to 7% of the mass of sulfuric acid for the inhomogeneous drop model. For the inhomogeneous cloud model the comparison leads to a minimum detectable mass of sulfur between 17% and 38% of the mass of the acid drops, depending upon the actual size of the large particles. It is concluded that moderately accurate 3.4 microns reflectivity observations are capable of detecting quite small amounts of elemental sulfur at the top of the Venus clouds. G.Y.

N79-22989*# Martin Marietta Labs., Baltimore, Md.
PETROGRAPHIC AND PETROLOGICAL STUDIES OF LUNAR ROCKS Final Report, 5 May 1977 - 4 Feb. 1978
Stephen R. Winzer 1 May 1978 59 p refs
(Contract NAS5-24163)
(NASA-CR-159921; MML-TR-78-11c) Avail: NTIS HC A04/MF A01 CSCL 03B

Clasts, rind glass, matrix glass, and matrix minerals from five Apollo 15 glass-coated breccias (15255, 15286, 15465, 15466, and 15505) were studied optically and with the SEM/microprobe. Rind glass compositions differ from sample to sample, but are identical, or nearly so, to the local soil, suggesting their origin by fusion of that soil. Most breccia samples contain green or colorless glass spheres identical to the Apollo 15 green glasses. These glasses, along with other glass shards and fragments, indicate a large soil component is present in the breccias. Clast populations include basalts and gabbros containing phases highly enriched in iron, indicative of extreme differentiation or fractional crystallization. Impact melts, anorthosites, and minor amounts of ANT suite material are also present among the clasts. Tektite glasses, impact melts, and breccias from the Zhamanshin structure, USSR, were also studied. Basic tektite glasses were found to be identical in composition to impact melts from the structure, but no satisfactory parent material has been identified in the limited suite of samples available. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-22990*# Spectra Optics, Sylmar, Calif.
A QUERY INTO THE SOURCE OF PROTON EMISSION FROM SOLAR FLARES, REPORT 2 Final Report
Sara F. Martin Feb. 1979 32 p refs
(Contract NAS8-32855)
(NASA-CR-161209) Avail: NTIS HC A03/MF A01 CSCL 03B

Seven solar flares that were followed by major proton events were examined to determine the diverse and common properties of major flares. The most probable site of primary proton acceleration is cospatial with the site and instant of formation of coronal loops. Because loop formation occurs through the entire duration of major solar flares over significantly large areas of active centers, it is proposed that proton injection occurs from a relatively large volume of space in the corona of active centers and is continuous throughout, and possibly even after, the visible duration of the related chromospheric flare. The flare

veil is hypothesized to occur as a result of proton charge exchange taking place in the white-light transient. The Kopp and Pneuman model of loop formation by magnetic reconnection is suggested as an adequate and satisfactory model for all major flares with the provision that the beginning of rapid magnetic field reconnection is coincident with flare start. A.R.H.

N79-22991*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A NEW SUN: THE SOLAR RESULTS FROM SKYLAB
John A. Eddy and Rein Ise, ed. Washington 1979 120 p Original contains color illustrations
(NASA-SP-402) Avail: NTIS MF A01; SOD HC $10.50 CSCL 03B

The highlights of the new and exciting pictures of the sun as taken by Skylab astronauts are presented. Topics of discussion and pictures include: (1) the nearest star; (2) the masks of the sun; (3) the sun from space; (4) the solar telescope on Skylab; and (5) the solar results from Skylab - the quiet sun and the active Sun. G.Y.

N79-22992# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MODELS FOR SOLAR CORONAL HOLES Final Report, 1 Aug. 1976 - 31 Jul. 1978
George L. Withbroe 30 Sep. 1978 21 p refs
(Contract F19628-76-C-0281)
(AD-A063195; AFGL-TR-78-0217) Avail: NTIS HC A02/MF A01 CSCL 03/2

This report summarizes several investigations of coronal holes and quiet regions. Temperature-density models for those regions have been derived from EUV observations. It is found that the coronal temperature, density, and temperature gradient are lower in coronal holes than in quiet regions. There is evidence for a positive temperature gradient to heights of 0.3 solar radii in quiet regions and 2.5 solar radii in coronal holes. Author (GRA)

N79-22993# Michigan State Univ., East Lansing.
SOLAR ATMOSPHERIC DYNAMICS Progress Report, 1 Mar. 1977 - 28 Feb. 1978
R. F. Stein Sep. 1978 20 p
(Contract F19628-77-C-0068)
(AD-A063197; Scientific-1; AFGL-TR-78-0237) Avail: NTIS HC A02/MF A01 CSCL 03/2

We have studied the heating of the solar chromosphere and corona, and the propagation of acoustic waves through the transition region between the chromosphere and corona. In order to place an upper limit on the effectiveness of acoustic waves in heating, we have written and tested a computer program to accurately calculate the propagation and dissipation of vertically travelling acoustic waves which includes thermal conduction and radiative transfer. In order to study heating by other possible waves, in particular magneto-acoustic-gravity waves, we have written and are now testing a computer program which approximately includes horizontal motions. In order to study the effects of horizontal inhomogeneities we have started developing a three-dimensional fluid dynamic computer program. We have also studied the propagation of acoustic waves through the solar transition region. We find that waves with velocity amplitudes compatible with observations near the temperature minimum (less than + or - 1 km/s) transmit too little flux through the transition region (- 20,000 erg/sq. cm. -s) to heat the corona.
Author (GRA)

N79-22994# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 413, JANUARY 1979, PART 1 (PROMPT REPORTS). DATA FOR NOVEMBER AND DECEMBER 1978
Helen B. Coffey Jan. 1979 161 p 2 Vol.
(PB-292636/8; SGD-413-Pt-1; NOAA-79021402) Avail: NTIS HC A08/MF A01 CSCL 03B

This prompt report provides data for December 1978 on: alert period, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, solar wind measurements, inferred IP magnetic field polarities, mean solar magnetic field and Boulder geomagnetic substorm log. It also provides data for November 1978 on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio waves, cosmic rays, geomagnetic indices and radio propagation indices. GRA

N79-22995# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 413, JANUARY 1979, PART 2 (COMPREHENSIVE REPORTS). DATA FOR JULY 1978 AND MISCELLANEA
Helen B. Coffey Jan. 1979 96 p 2 Vol.
(PB-292637/6; SGD-413-Pt-2; NOAA-79021403) Avail: NTIS HC A05/MF A01 CSCL 03B

This comprehensive report provides data for July 1978 on: active regions, synoptic solar maps, solar flares, solar radio waves and energetic solar particles and plasma. It also provides a synoptic chart, abbreviated calendar record and regional flare index for June 1978. The miscellaneous data includes: geomagnetic indices and energetic solar particles for May and June 1978. GRA

N79-22158*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISE EXTRACTION OF GEOMETRICAL DEPENDENCE FROM SOLAR WIND COLUMNAR TURBULENCE MEASUREMENTS
A. L. Berman *In its* The Deep Space Network 15 Apr. 1979 p 110-118 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

N79-22160*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A UNIFIED OBSERVATIONAL THEORY FOR SOLAR WIND COLUMNAR TURBULENCE
A. L. Berman *In its* The Deep Space Network 15 Apr. 1979 p 124-131 refs (For primary document see N79-22140 13-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

No abstracts in this category.

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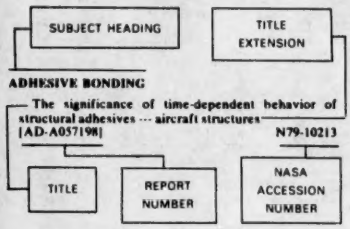

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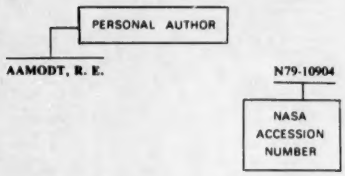

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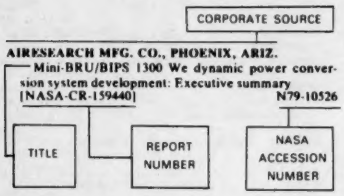

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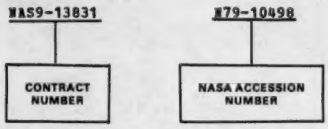

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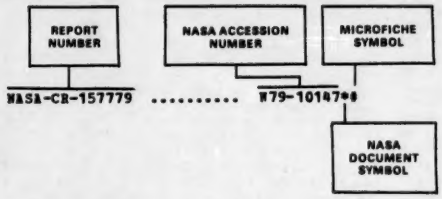

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